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SPILL ASSESSMENT MODEL (SAM) PROCEDURE FOR MANUAL FIELD CALCULATIONS

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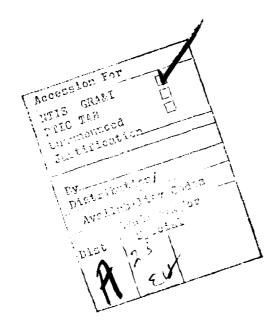
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# 20. ABSTRACT (CONCLUDED)

OF CERTAIN TYPES OF SPILLED CHEMICALS IN WATER AS DEVELOPED IN ESL-TR-80-07. THE CALCULATION PROCEDURES FOR FIELD USE HAVE BEEN DEVELOPED IN THE FORM OF A SERIES OF GRAPHS AND TABLES, AND PERMIT HAZARD EXTENT ESTIMATES TO BE RAPIDLY MADE WHEN TIME OR RESOURCES ARE NOT AVAILABLE FOR MORE COMPLEX COMPUTATION. THE DATA REQUIRED FOR THESE FIELD COMPUTATIONS CAN BE IMMEDIATELY OBTAINED OR ESTIMATED.

THE PROCEDURES FOR FIELD USE MAY BE APPLIED TO OBTAIN ESTIMATES OF THE CONCENTRATION IN WATER RESULTING FROM THE SPILL OF A SOLUBLE CHEMICAL HAVING A DENSITY CLOSE TO THAT OF WATER. IT IS ASSUMED THAT THE CHEMICAL IS FULLY SOLUBLE IN WATER, AND THAT ALL THE DISCHARGED CHEMICAL GOES INTO SOLUTION WITH WATER. IN PARTICULAR, EFFECTS OF CHEMICAL REACTIONS, PHASE CHANGES, OR VAPORIZATION FROM A SPREADING LIQUID ARE NOT INCORPORATED; THESE ASSUMPTIONS LEAD TO ESTIMATES OF CONCENTRATIONS IN WATER THAT ARE CONSERVATIVE, THE INTERACTIVE COMPUTER MODEL VERSION DISCUSSED IN ESL-TR-80-27 DOES NOT MAKE THESE ASSUMPTIONS.

SPECIFICALLY, THE PART OF SAM UTILIZED AS THE BASIS FOR THE FIELD CALCULATIONS ADDRESSES ONLY INSTANTANEOUS POINT SOURCE DISCHARGES INTO A FLOWING RIVER. FOR FIELD USE, THE PRIMARY REQUIREMENT IS TO ASSESS THE MAXIMUM CONCENTRATIONS WHICH MAY RESULT FROM A SPILL AT VARIOUS DISTANCES FROM THE SPILL LOCATION, AND TO DETERMINE THE MAXIMUM DISTANCES OVER WHICH THE CONCENTRATION IN WATER WILL EXCEED ANY SPECIFIED HAZARD LEVEL.



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# **PREFACE**

This report was prepared by Arthur D. Little, Inc., Acorn Park,

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AFESC.

This report has been reviewed by the Public Affairs Office (PA) and is releasable to the National Technical Service (NTIS). It will be available at NTIS to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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# SECTION I

# INTRODUCTION

Current U.S. Air Force operations dictate the use of numerous toxic substances, and among these are the three hydrazine family fuels (anhydrous, unsymmetrical dimethyl and monomethyl hydrazine). Hydrazine fuels are the basic rocket propellant for strategic missiles and satellites, and the joint NASA and U.S. Air Force sponsored Space Shuttle Program will greatly increase the volume of hydrazine in general use. Bulk storage and transport of hydrazine fuels could lead to accidental discharges, and if a discharge finds its way into a water body, undesirable consequences could occur to the aquatic ecosystem. The objective of the work described in this report was to develop a mathematical model for application in assessing the impact of catastrophic spills. The Spill Assessment Model, SAM, is now available at two levels: (1) this field manual which provides simple calculation procedures that can be rapidly applied to obtain estimates of hazard levels, and (2) an interactive computerized version of the model which allows a more detailed and precise analysis of spill events (ESL-TR-80-27). The model development is documented in ESL-TR-80-07.

The purpose of this manual is to provide a simple calculation procedure that can be rapidly applied in the field to obtain estimates of the potential extent of hazard levels from such a discharge. These field procedures have been derived from complex analytical and computer based models describing the behavior of certain types of spilled chemicals in water. The calculation procedures for field use have been developed in the form of a series of graphs and tables and permit hazard extent estimates to be rapidly

made when time or resources are not available for more complex computation. The data required for these field computations can be immediately obtained or estimated.

The calculations described in this manual necessarily incorporate a number of assumptions and limitations, the majority of which are reviewed in Section V. The procedures for field use may be applied to obtain estimates of the concentration in water resulting from the spill of a soluble chemical having a density close to that of water. It is assumed that the chemical is fully soluble in water, and that all the discharged chemical goes into solution with water. In particular, effects of chemical reactions, phase changes, or vaporization from a spreading liquid are not incorporated; these assumptions lead to estimates of concentrations in water that are conservative.

Specifically, the Spill Assessment Model (SAM) utilized as the basis for the field calculations addresses instantaneous point source discharges into a flowing river. For field use, the primary requirement is to assess the maximum concentrations which may result from a spill at various distances from the spill location and to determine the maximum distances over which the concentration in water will exceed any specified hazard level. The objective of the field procedure is to provide a means of rapidly assessing the approximate extent of concentrations in water in excess of hazard levels.

The extent to which other hazards, such as vapor dispersion, may be associated with a spill will depend on the specific discharging substance. The field procedures described in this manual are intended for use with soluble, neutrally bouyant substances, and address only dispersion in water. For related hazards, or different types of hazards resulting from spills

of different classes of chemicals, reference sources such as the Chemical Hazard Response Information System (CHRIS) of the U.S. Coast Guard should be consulted; the methods, approach and data contained in this manual have been derived from that system. The analytical basis for the formulation of these field calculations is also documented in a separate technical report (ESL-TR-80-07).

# SECTION II

#### CALCULATION PROCEDURE

# 1. INTRODUCTION

The hazard assessment calculation procedure described in this section assumes that the released chemical is instantaneously spilled into a flowing river or stream. The case of a continuous release of a chemical into water is treated only in the computerized counterpart of this procedure. A hazard assessment based on an instantaneous release provides conservative estimates of the hazard.

The calculation procedure addresses spills of chemicals which are soluble in water, liquid at ambient temperature, and not much heavier than water.

The spilled chemical will both spread and mix with water at the same time.

The concentration of the chemical in water will remain a hazard until dilution by mixing and diffusion sufficiently reduces the concentration.

Spills which occur in flowing streams are of particular concern because soluble chemicals, once in solution, will be confined by the banks of the stream and will remain a hazard as they flow downstream. Spills which occur in tidal areas are not usually confined, particularly during ebb tide, and rapid mixing occurs to reduce the concentration in the water. Spills which occur on calm, current-free water are not common in navigable waters.

When the mass of the spill chemical is discharged, it tends to move away from the source or spill location with a speed and direction determined by the prevailing bulk fluid velocity of the receiving water body, i.e., flowing river. The mean speed and direction of the moving chemical mass can be expected to change from the original values during its travel as

the pattern of river currents in which it is embedded changes with time. Since specification of river current variations is not practical within the objectives of the field calculation procedure, a limiting assumption is employed that the river flows with a constant cross-sectional velocity so that the center of mass of the spilled chemical moves downstream, along a longitudinal line from the spill location, at a constant rate equal to the river velocity.

As the chemical mass moves downstream, it will expand about its center owing to the action of turbulent motion. The entire mass will be carried downstream in a uniform manner, and the mass will grow in size as its edges are mixed with the water by turbulence. This growth is accompanied by a proportional decrease in concentrations within the chemical mass. At any particular time after the discharge occurs, the greatest concentration in water will occur at the location of the center of the moving chemical mass. As the chemical continues to move and spread, this maximum concentration is similarly reduced.

The degree of spreading which occurs as the chemical moves downstream depends on the river velocity, channel roughness, and the size and shape of the river channel. Faster spreading causes a more rapid decrease of the maximum concentration at the center of the moving chemical mass.

Discharges of a chemical may occur at any point in the river channel. The behavior described above of the discharged chemical in a flowing river approximates discharges which occur near the center of the river, removed from immediate influences of the river banks. For discharges which occur close to shore, the spreading of the chemical in water will quickly become

distorted by the nearer shore. Within a downstream distance equal to rough—
ly four or five times the river width, the field calculation procedure can
obtain only very approximate estimates for concentrations from spills ac—
tually occurring close to shore. At greater distances a more accurate
representation is obtained since the local effects of the spill conditions
become diminished as the moving chemical mass becomes distributed throughout
the river channel.

# 2. REQUIRED DATA

The data items required to perform the field calculation procedure are:

a. Channel Width = the average width of the river channel in feet.

For channel widths obtained in other units, conversion to units of feet is required. The calculation procedure employs a series of graphs each of which is used for a range of values of the channel width.

For any particular river channel, the average channel width can be estimated by selecting the appropriate range from the list given below. For river widths near the separation between two categories, the category containing smaller values should be selected.

- (1) Width less than 75 feet
- (2) Width 75 to 200 feet
- (3) Width 200 to 400 feet
- (4) Width 400 to 800 feet
- (5) Width 800 to 1200 feet
- (6) Width 1200 to 1800 feet

- (7) Width 1800 to 2200 feet
- (8) Width 2200 to 2800 feet
- (9) Width 2800 to 3400 feet
- (10) Width greater than 3400 feet
- b. <u>Channel Depth</u> = the average depth of the river channel in feet.

  For channel depths obtained in other units, conversion to units of feet is required. The calculation procedure employs different graphs for different river depths varying from 5 to 200 feet.

  However, reasonable ranges of river depth values generally differ for different river widths, and the calculation procedure uses different depth curves on each graph. The curve corresponding to the next smaller river depth should be selected.
- c. <u>Spilled Amount</u> = the total quantity of liquid chemical discharged into the water in tons. If estimates of the quantity spilled are obtained in other units, conversion to units of tons is required.
- d. <u>Downstream Distance</u> = the distance downstream from the location of the spill at which an estimate of the maximum concentration is to be obtained. Concentration values are tabulated for a range of downstream distances from 0.1 to 100 nautical miles. If the distance is obtained in other units, conversion to nautical miles is required (1 nautical mile = 1.15 statute miles = 6076 feet). Values of concentration factors can be obtained directly from graphs for any downstream distance between 0.1 and 100 nautical miles.
- e. <u>Hazardous Concentrations</u> = the calculation procedure determines the maximum concentration at a given location, or the extent over which

concentrations may be expected to exceed any particular hazard level. These concentrations are expressed in units of milligrams per liter. To utilize or interpret this information, an evaluation of the concentrations at which different levels of hazard are considered to exist is necessary. These hazard levels will depend on the toxicity of the chemical, the different types of aquatic organisms of concern, spill consequences in terms of water use (e.g., industrial intake or public consumption), and other similar types of factors.

# 3. PROCEDURE

When a low-density chemical spill occurs on a flowing stream, two calculations can be made, depending upon the parameters given and the results desired:

(1) the concentration of the chemical in the water at some distance downstream from the spill site, or (2) the distance downstream from the spill site where the chemical concentration in water is no longer considered a hazard.

The material that follows gives a guide to the procedure for field calculation and presents both a sample calculation and, immediately alongside the sample, an area where the exact hazard for the chemical and spill condition under consideration may be calculated. Calculations can then be made right on the page alongside the sample calculation. The calculation should be made in pencil, so that the results may be erased and the calculation sheet reused. The sample calculation should be studied carefully to understand how the answers are derived for the sample calculation before proceeding with the calculation of the hazards for the chemical spill under consideration.

# a. Downstream Concentration at any Point

Tabulate below the information required for calculating the water pollution hazards in a flowing stream at some distance downstream from the spill site:

SAMPLE CALCULATION	CALCULATION PROCEDURE (use pencil so it can b	e erased)
Chemical: <u>Hydrazine</u>		<del></del>
Amount Spilled: 20 tons		tons
Stream Width, W 300 feet	W =	feet
Stream Depth, d <u>30 feet</u>	d =	feet
Select a distance x of interest		
downstream. For example $x = 0.5$		
nautical mile downstream of the		
spill	x =	nautical miles
· · · · · · · · · · · · · · · · · · ·	1	

Place a check mark next to the stream width which most closely matches the above tabulated stream width and determine the figure to be used in the calculation procedure. For stream widths on the border, use the smaller category.

Stream Width (feet)	Figure to be Used	For Example	Calculation Procedure
0-75	A-1		· · · · · · · · · · · · · · · · · · ·
75-200	A-2	·	
200-400	A-3		-
400-800	A-4		

800-1200	A-5	 
1200-1800	A-6	 <del></del>
1800-2200	Λ-7	
2200-2800	A-8	 
2800-3400	A-9	 
Greater than 3400	A-10	 

Determine the chemical concentration per ton spilled factor (C/T) from the stream depth (d), the distance downstream from the spill (x), and the figure identified above. The figures are given in Appendix A of this manual. Do not interpolate between stream depths; use the next smaller stream depth.

For the 20-ton spill of hydrazine in a stream which is 300 feet wide and 30 feet deep, use the 20-foot depth curve on Figure A-3 to determine the concentration factor (C/T) of hydrazine 0.5 nautical mile downstream of the spill.

Concentration = 
$$\frac{800 \text{ mg/liter}}{\text{per ton spilled}}$$
 =  $\frac{\text{mg/liter per ton spilled}}{\text{spilled}}$ 

Calculate the concentration at the downstream site from the factor (C/T) and the following equation:

Concentration C = (C/T) (Tons spilled)

For the 20-ton spill of hydrazine, the factor C/T = 800 mg/liter per ton spilled and the tons spilled T = 20

C = 
$$(800)$$
  $(20)$  =  $\underline{16,000}$  mg/liter  
at x = 0.5 nautical mile downstream

C = ( ) ( ) = \_\_\_\_ mg/lite

# b. Downstream Extent of Hazard

To determine the distance downstream from the spill site where the chemical concentration is no longer considered a hazard, enter below the desired concentration limit in water in mg/liter for the specific chemical (a limit value of 10,000 mg/liter is used below for illustration only).

For the 20-ton hydrazine spill  $\,$ 

Concentration = 10,000 mg/liter

mg/liter

Calculate the limit concentration factor  $\left(\text{C/T}\right)_L$  from the concentration limit and the following equation:

 $(C/T)_L = \frac{(Concentration Limit)}{(Tons Spilled)}$ 

For the 20-ton hydrazine spill

$$(C/T)_L = \frac{(10,000)}{20} = \frac{500}{20} \frac{\text{mg/liter}}{\text{per ton spilled}} = \frac{(\phantom{0})}{(\phantom{0})} = \frac{\text{mg/liter}}{\text{per ton spilled}}$$

Determine the maximum downstream extent of the hazard from the factor  $\left(C/T\right)_{\text{I}}$ , the stream depth (d), and the figure identified above.

For the 20-ton hydrazine spill in a stream which is 300 feet wide and 30 feet deep, use the 20-foot depth curve on Figure A-3 and a  $\left( \frac{C}{T} \right)_{L} = 500$  to determine the maximum downstream distance for the hazard concentration limit.

Maximum hazardous = 0.85 nautical mile = \_\_\_\_\_ nautical miles

The above procedures are summarized in Figures 1 and 2 and are provided for quick reference.

The peak concentration at any intermediate point between the spill site and the maximum hazardous distance -- and for that matter any point beyond this maximum distance -- can be read directly off the figure used above by just following the depth curve and reading the concentrations at various

1,000

What is the concentration of hydrazine QUESTION:

0.5 nautical miles downstream?

(x = 0.5 mi)

(mg/LITER PER TON OF SPILLED CHEMICAL) CONCENTRATION FACTOR

(T334) HT930

000

20

10

100

5

2

# SOLUTION:

- (1) Select appropriate Figure from the Field Manual using river width.
- so select lower "d" value. Interpolation is not recommended). Read concentration factor, C/T, from Figure using x = 0.5 mi and d = 20 feet (d = 30 feet is not on Figure; (2)

$$\frac{C}{T} = 800 \frac{mg/l}{tons spilled}$$

Solve for concentration: <u>(3</u>

1.0

$$C = (T) 800 \frac{mg/l}{tons spilled}$$

$$C = 16,000 \text{ mg/l}$$



Figure 1. Concentration of Hydrazine at 0.5 Nautical Miles from Spill Site.

PROBLEM: Hydrazine Spill

SCENARIO: Amount Spilled;

T = 20 tons Stream Width; W = 300 feet Stream Depth;

ream Depth; d = 30 feet QUESTION: What distance downstream will the concen-

tration in the river be no higher than

10,000 mg/l?

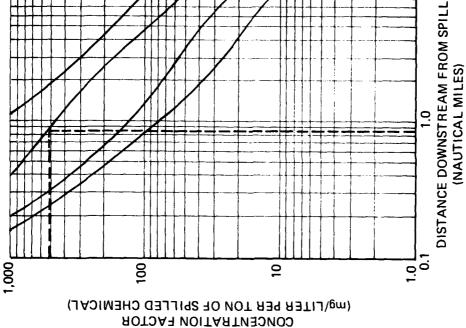
# SOLUTION:

- (1) Select appropriate Figure from the Field Manual using river width.
- (2) Calculate the limit concentration factor, (C/T)  $_{\rm l}$ .

C/T)<sub>1</sub> =  $\frac{10,000 \text{ mg/l}}{20 \text{ tons spilled}}$  =  $\frac{500 \text{ mg/l}}{1000 \text{ tons spilled}}$ 

(3) Read distance from the Figure

x = 0.85 nautical miles



DEPTH (FEET)

20

20

10

100

CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 200 TO 400 FEET)

Figure 2. Distance Downstream Where Concentrations are not Higher than 10,000 mg/l.

downstream distances. These concentrations are based on "per ton of chemical spilled," and therefore must be multiplied by the number of tons spilled to give the actual peak concentrations. In addition, the time that the peak concentration of the chemical will reach a given point downstream is simply that distance divided by the stream velocity. However, some of the chemical may reach a given point downstream well before the peak concentration does.

Appendix A of this manual contains the necessary graphs, Figures A-1 to A-10, for the field calculation procedure. Section IV of this manual describes a series of data tables, from which the graphs were prepared, which may be similarly used. The data tables are contained in Appendix B of this manual.

# SECTION III

# USE OF GRAPHS FOR CALCULATION PROCEDURE

The 10 graphs presented in Appendix A are used with a simple calculation procedure to determine the maximum downstream concentration in water of a soluble chemical which has spilled into a flowing stream.

The graphs give the concentration factor as a function of distance downstream from the spill site and the depth of the stream for various width ranges of the stream.

For actual estimated river depths between those values displayed, interpolation may be used for approximate results, or the next smaller stream depth curve selected for conservative results.

Each graph corresponds to a range of values for the stream width. Select the appropriate graph for the width of the stream into which the spill has occurred. For stream widths close to the limit of a range, select the graph for the smaller category for conservative results. The graphs and corresponding width intervals are:

Stream Width (feet)	Figure to be Used
0-75	A-1
75–200	A-2
200-400	A-3
400-800	A-4
800-1200	A-5
1200-1800	A-6

Stream Width (feet)	Figure to be Used
1800-2200	A-7
2200-2800	A-8
2800-3400	A-9
Greater than 3400	A-10

Quantities used or determined from these graphs are measured in units of:

Stream width in feet

Stream depth in feet

Distance downstream from spill site in nautical miles

Concentration factor in mg/liter per ton of spilled chemical.

# SECTION IV

# USE OF DATA TABLES

The 10 tables presented in Appendix B contain values of the concentration factor tabulated for a range of values of stream width, stream depth, and distance downstream from the spill location. Data contained in these tables were selected to prepare the graphs for the manual calculation procedure given in Appendix A. In some cases the tables also contain additional data points which could be useful for unusual channel geometries or as interpolation aids.

The tables give the concentration factor as a function of distance downstream from the spill site and the depth of the stream for various values of stream width.

For actual estimated river depths between those values displayed, interpolation may be used for approximate results, or the next smaller stream depth column may be selected for conservative results.

Each table corresponds to a range of values for the stream width. Select the appropriate table for the width of the stream into which the spill has occurred. For stream widths close to the limit of a range, select the table for the smaller category for conservative results. The tables and corresponding width intervals are:

Stream Width (feet)	Table to be Used
0-75	B-1
75-200	B-2
200-400	B-3

Stream Width (feet)	Table to be Used
400-800	B-4
800-1200	B-5
1200-1800	B-6
1800-2200	B-7
2200-2800	B-8
2800-3400	В-9
Greater than 3400	B-10

Quantities used or determined from these tables are measured in units of:

Stream width in feet

Stream depth in feet

Distance downstream from spill site in nautical miles

Concentration factor in mg/liter per ton of spilled chemical.

#### SECTION V

#### ANALYTICAL BACKGROUND

# 1. INTRODUCTION

The graphs and tables contained in this field manual are based on an analysis of the dispersion of a spilled chemical into a flowing river. Details of the formulation of the equations governing the concentration behavior are described in a separate report (ESL-TR-80-07). In this section of this report, the resulting general equations are assumed to be given, and the computations then required to prepare the graphs and tables for field use are described. Maximum concentrations are obtained by assuming instantaneous instead of continuous release conditions.

Dispersion of a spilled chemical into a non-tidal river can be viewed as equivalent to dispersion in still water, subject to the influence of two additional factors: the bulk fluid motion of the river current, and the constraints imposed by the banks and bottom of the river channel. For a spill into still water, the movement of the spilled chemical occurs in all directions away from the center of mass of the spilled chemical. The center of mass remains stationary at the spill location, and the maximum or peak concentration at any time after the start of the spill occurs at the spill location.

For a river setting, the river channel is assumed to be rectangular, of uniform cross-section, and a rectangular coordinate system is taken with the origin at the center of the channel on the water surface where x gives downstream distance from the spill location, y gives the

cross-channel position, and positive z gives depth so as to form a right-handed coordinate system. Considering only the influence of the river motion, the flow is assumed to be uniform across the cross-section of the river, in the direction of the positive x axis, and the velocity is given as u. The center of mass of the dispersing chemical is transported downstream by the bulk fluid motion, moving with a velocity u so that the distance moved in time t is given by ut. Relative to the center of mass of the spilled substance, the coordinates become stationary, and the type of dispersion behavior of the still water case applies. That is, at any time t, after the start of the spill, the maximum concentration for any location in the river channel occurs at the location of the center of mass of the spilled chemical.

About the center of mass of the spilled substance, the initial concentration distributions are Gaussian so that for times greater than zero, the concentrations decrease with distance from the center of mass, but have some value at all distances. However, at very large distances, the concentrations are very small. Conservation of mass can be applied to define a region of the water body, or "volume," centered about the center of mass of the spilled substance, within which some fixed amount, for example 95 percent of the total dispersing mass is initially contained.

As the elapsed time from the start of the spill increases, the "volume" containing the dispersing chemical both moves downstream with a velocity u and grows in size. The growth continues until either a channel bank or the river bottom is encountered. Further growth in that direction is impeded, and the nature of the concentration distribution is modified. It is assumed that these boundaries are impenetrable, thus the amount of substance

contained in the portion of the volume that would have grown beyond the channel banks or bottom is "reflected" back into the river channel. The method of obtaining the additional contributions to the concentration in the river channel of the reflected amount of substance involves summing concentration distributions from additional virtual spill sources or "images" located outside the boundaries of the river channel.

The resulting equation used to describe this behavior is given as:

$$c(x,y,z,t) = \frac{2M}{(4\pi t)^{3/2} \sqrt{e_x e_y e_z}} \cdot e^{-kt} \cdot e^{-\frac{(x-ut)^2}{4 e_x t}}$$

$$\cdot \left[ -\frac{(y-a)^{2}}{4 e_{y} t} - \frac{(y+a+w)^{2}}{4 e_{y} t} - \frac{(y-w+a)^{2}}{4 e_{y} t} \right] \\
\cdot \left[ -\frac{z^{2}}{4 e_{z} t} - \frac{(z-2d)^{2}}{4 e_{z} t} - \frac{(z+2d)^{2}}{4 e_{z} t} \right] \\
\cdot \left[ -\frac{z^{2}}{4 e_{z} t} + e + e - \frac{(z-2d)^{2}}{4 e_{z} t} - \frac{(z+2d)^{2}}{4 e_{z} t} \right]$$

where:

c(x,y,z,t) = concentration at a location x, y, z, and at time t after start of spill, gm/cm<sup>3</sup>

x,y,z = coordinates of point in river channel at which concentration is obtained, cm

t = elapsed time from start of spill, sec

M = quantity of liquid substance released, gms

k = decay coefficient, sec -1

u = stream velocity, cm/sec

 $e_{x}^{e}, e_{y}^{e} = turbulent dispersion coefficients, cm<sup>2</sup>/sec$ 

w = mean river channel width, cm

d = mean river channel depth, cm

a = spill offset; location of spill across channel
 width relative to river centerline, cm

When spilled into a stream or river, the behavior of a chemical depends on a number of factors. These include the physical and chemical properties of the chemical, the flow conditions in the river, and the location and nature of the release. If the area of the source of the spill is small in relation to the size of the river, the dispersion of the chemical will be in all directions. In this phase, the dispersion is three dimensional, and the concentrations obtained from the above equation depend on the coordinates (x,y,z) of the location of interest. It can be seen that at any time t, during the initial stages of dispersion, the maximum concentration occurs at the surface (z=0), at a cross channel location equal to the spill offset (y=a) if the offset, a, is less than the half-width of the river, and at a downstream distance (x=ut) corresponding to the bulk motion of the center of mass of the spilled chemical.

Near the spill location, the concentrations are significantly dependent on the location of the spill, manner of release, and a range of other local effects. As the distance from the spill location increases, the concentrations obtained from this equation tend to become evenly distributed over the cross-section of the river, and localized effects of the spill conditions are reduced.

Since the cross-sectional variations of concentration are significant during this early stage of spreading, descriptions of the shape of the river cross-section and the river velocity distribution across the cross-section are necessary. The concentration equation assumes a rectangular channel cross-section of constant width and depth, and a constant river velocity, uniform over the river cross-section.

As the dispersion chemical mass moves downstream, the maximum concentration occurs at the location of the moving center of mass, which is translated in the longitudinal direction of river motion as long as the confining effects of the river channel banks and bottom are minimal. At longer distances from the spill location, depending on the cross-channel position of the spill location, reflections of the dispersing chemical will cause the location of maximum concentration to drift away from this axis. However, if the spill location is assumed to be at the center of the river, symmetry gives the result that the location of maximum concentration continues to occur at the centerline.

Graphs and tables of maximum concentration are then obtained from the general equation using coordinate values x = ut, y = 0, z = 0, and the spill location is taken to be at the center of the river, using a=0. Since the general concentration equation includes, to within a first order approximation, terms to account for the reflection of dispersing chemical by the channel banks and boundaries, this equation is used for all distances from the spill location. For large distances from the spill location, an alternate formulation of the concentration equation can be obtained based on the assumption that the spreading chemical has become uniformly distributed over the cross-section of

the river channel. This approach is briefly described in a following section, however, since terms accounting for the reflections from the river channel banks and boundaries were incorporated in the general concentration equation given above, adaptation of this alternate formulation for field use was not necessary.

# 2. EVALUATION

# a. Simplification of Equation

As discussed above, the graphs and tables of maximum concentration for field use were obtained by setting the coordinates y=z=0, the spill offset, a, to zero, and x=ut. Since the maximum concentration at a location x occurs at a time equal to  $\frac{x}{u}$ , substitution of these coordinates gives an expression for the maximum concentration directly as a function of x and not t. In addition, further substitution shows that the velocity terms cancel, so that the maximum concentration as a function of x is independent of the river velocity x.

The effect of chemical decay or degradation in the aquatic environment is included in the general concentration equation by the term  $e^{-kt}$  which models an exponential decay process. The decay results in a reduction of the total quantity of dispersing chemical, which in turn directly reduces the resulting estimates of concentrations. Since in many cases products of decay or decomposition are also hazardous, conservative concentration estimates are obtained by taking k=0.

Substitution of these values gives the equation for the maximum concentration as:

$$c(x) = \frac{2M}{(4\pi \frac{x}{u})^{3/2} \sqrt{\frac{e_x e_y e_z}{x}}} \cdot \left[ 1 + 2 e^{-\frac{x^2 u}{4 e_y x}} \right] \cdot \left[ 1 + 2 e^{-\frac{d^2 u}{e_z x}} \right]$$

where c(x) gives the maximum concentration at a location x as a function of:

- x, downstream distance from the spill location
- w, mean river width
- d, mean river depth
- M, total quantity of spilled chemical, and
- $e_{x}, e_{y}, e_{z}$ , dispersion coefficients.

The velocity u appearing in the equation is removed when empirical expressions for the dispersion coefficients are substituted.

# b. Evaluation of Dispersion Coefficients

The concentration equation is written above in Centigrade-Gram-Secono (CGS) units, and the appropriate equations for the turbulent dispersion coefficients are given by:

$$e_z = 0.067 U^* R_h$$

$$e_x = 0.1 e_z$$

$$e_y = 0.23 \text{ U}^* R_h \qquad \text{if } \frac{w}{d} < 100$$

$$e_y = e_x$$
 if  $\frac{w}{d} > 100$ 

The ratio of river width to depth is used to obtain different expressions for the coefficient  $e_y$  for narrow rivers ( $\frac{w}{d}$  < 100) or wide rivers ( $\frac{w}{d}$  > 100).

The hydraulic radius,  $R_{\hat{h}}$ , is given by the cross sectional area divided by the wetted perimeter:

$$R_h = \frac{w \cdot d}{2 d + w}$$

The shear velocity, U\*, in units of cm/sec is given by:

$$U* = 6.7305 \text{ n} \cdot \frac{u}{R_h^{1/6}}$$

where n is the Manning roughness coefficient. In this formulation for field application, a coefficient value of n = 0.03 is assumed, and the dispersion coefficients are obtained as functions of w, d, and u.

Substitution gives the values of the dispersion coefficients in units of  $cm^2/second$ , for n=0.03, as:

$$e_x = (1.353 \times 10^{-3}) u \cdot R_h^{5/6}$$

$$e_z = 10 \cdot e_x$$

$$e_y = (4.644 \times 10^{-2}) \text{ u} \cdot R_h^{5/6} \quad \text{for } \frac{w}{d} < 100$$

or

$$e_y = e_x$$
 for  $\frac{w}{d} > 100$ 

## c. Selection of Parameters

Since by substitution the velocity terms, u, cancel, the maximum concentration for the particular assumptions employed reduces to a function only of river width (w), river depth (d), downstream distance from the spill location (x), and total quantity spilled (M).

Since the maximum concentration at a location x is directly proportional to the total quantity spilled, the graphs for field use are generated to obtain the ratio  $\frac{c(x)}{M}$ , or concentration per unit quantity spilled, as a concentration factor. In application, the estimate of actual concentration is obtained by multiplying the total quantity of substance by the appropriate value of the factor. To express spill quantities in units of tons, the concentration factor is obtained by evaluating the concentrations resulting from a release of 1 ton of substance. Converting to CGS units for use in the concentration equation as written above gives:

M = (1.0) (2000) (454) in grams

A range of river width and depth values, in units of feet were selected to describe most river channel dimensions of practical concern, and concentrations were computed for each combination of values. All resulting computed values are given in the tables in Appendix B. However, the graphs in Appendix A show only the most realistic of these combinations. Values selected for river depths and widths were:

depth = 5, 10, 20, 30, 50, 100, 200 (feet)

width = 50, 160, 200, 400, 800, 1200, 1800, 2200, 2800, 3500 (feet)

For use with the concentration equation in CGS units these were converted to give:

d = (depth in feet) (12) (2.54) in cm

w = (width in feet) (12) (2.54) in cm

Concentrations were then obtained for plotting over downstream distances in units of nautical miles at points selected as:

distance = 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 20.0, 30.0, 40.0, 50.0, 60.0, 70.0, 80.0, 90.0, 100.0

Conversion to CGS units used:

$$x = (distance in n.m.) (2.54) (12) (5280) (1.15155) in cm$$

The concentration equation gives the result in units of gm/cm<sup>3</sup>; tabulation in units of mg/liter (per ton spilled) was obtained from:

concentration = 
$$(c \text{ in gm/cm}^3) \times 10^6$$
, mg/liter

## 3. ALTERNATE FORMULATION

The spreading of a spilled chemical is assumed to occur, in general, in three dimensions until further horizontal or vertical movement is constrained by the channel banks or bottom. For most river channels of practical interest, a spilled chemical will first become more or less uniformly distributed over the depth of the river, then further spreading horizontally occurs to produce a uniform distribution across the width of the river channel. The order of time for horizontal spreading to produce measurable concentrations at the river banks is given by:

$$t_c = \frac{b^2}{e_y}$$

where b =  $\frac{w}{2}$  is the half-width of the river channel.

The initial period,  $t_i$ , is defined as the duration over which three-dimensional spreading can be assumed to occur, and is given by:

$$t_i = 0.3 t_c = 0.3 \frac{b^2}{e_y}$$

Since the coordinate of the observation point of interest is taken at the center of mass of the spilled chemical, this criteria can be expressed in terms of an initial distance from the spill location,  $\mathbf{x_i}$ , which is given as:

$$x_i = u \cdot t_i = 0.3 u \frac{b^2}{e_y}$$

For distances x less than  $x_i$ , the effect of the channel banks in confining the distribution of the spilled chemical is small, and the equations for three dimensional spreading are used. For distances greater than  $x_i$ , the effects of the channel banks become more pronounced, and eventually the spilled chemical becomes uniformly distributed across the cross-section of the river channel. Further spreading occurs only longitudinally.

Since the three dimensional equation utilized to obtain the concentrations includes terms which account for the effects of the channel banks and boctom in confining the spreading, to a first order approximation, this equation has been used for all values of the distance from the spill location.

If however it is assumed that the chemical is uniformly mixed across the river channel cross-section, then the appropriate concentration equation for one-dimensional spreading is given by:

$$c(x,t) = \frac{M}{A\sqrt{4 \pi E t}} e^{-\frac{(x-ut)^2}{4 E t}} e^{-kt}$$

where c, M, t, x, u, and k are as defined previously. The cross-sectional area of the river channel is A, obtained from

$$A = w \cdot d \quad in \quad cm^2$$

and E is an effective longitudinal dispersion coefficient, in units of  ${\rm cm}^2/{\rm second}$ . The coefficient E represents not only the dispersion  ${\rm e}_{\rm X}$  but also the dispersion of the chemical due to the differential velocities and concentrations across the river channel. Since the formulation of the effective longitudinal dispersion coefficient E is different from  ${\rm e}_{\rm X}$ , and the one-dimensional equation is based on an assumption that complete uniform cross-sectional mixing has occurred, the concentrations obtained from the three-dimensional equation and the one-dimensional equation will generally be different, giving rise to a discontinuity between the concentrations computed from each equation. Since the basic assumptions underlying each equation differ, it is not necessarily advisable to artificially remove the discontinuity if the three dimensional and one-dimensional equations are applied to the same spill scenario.

Substituting for t from x=ut, and using k=0 and  $A=w\cdot d$ , gives the concentration equation in a reduced form as:

$$c(x) = \frac{M}{\text{wd}\sqrt{4 \pi E \frac{x}{u}}}$$

The longitudinal dispersion coefficient, E, is computed using the shear velocity and hydraulic radius from:

$$E = \alpha U^* R_h \text{ in cm}^2/\text{second}$$

where the constant  $\alpha$  depends on the ratio of the river width to depth:

$$\alpha = 20.22 \qquad \text{for } \frac{W}{d} < 100$$

$$\alpha = 225$$
. for  $\frac{w}{d} > 100$ 

It should be noted that the value of  $e_y$  used to obtain the initial time,  $t_i$ , or distance,  $x_i$ , is also similarly dependent on the width to depth ratio.

Since the dispersion coefficient, E, depends on the river velocity, u, in the same way as  $e_x$ ,  $e_y$ , and  $e_z$ , it can be seen that the resulting concentration, c(x), is independent of u. For a particular river channel cross section, this gives a concentration profile along the downstream direction that is inversely proportional to the square root of the distance from the spill location.

## 4. LIMITATIONS AND MAJOR ASSUMPTIONS

In addition to the basic assumptions underlying the derivation and formulation of the concentration equation utilized to produce the graphs and tables for field use, reviewed in following paragraphs, the analytical expression contains a singularity at the spill location. That is, the initial value of the concentration at the spill location is infinite, and for very small distances from the spill location, the peak concentration at the center of the moving spill mass may, as a result, exceed the density of the spilled chemical. For this reason, caution should be exercised to interpret estimated concentrations at locations very close to the spill location.

Because of the complexity of the chemical spill process, the uncertainties and variabilities associated with spill conditions and the nature of the environment in the vicinity of the spill, and the difficulties inherent in describing these phenomena, the analysis and implementation of the water dispersion model, from which the field calculation procedures were derived, has necessarily been based on numerous assumptions. Further assumptions were then introduced to enable simplification of the calculations for field use. The degree of sophistication attempted was carefully considered, and assumptions or limitations introduced to enable the model to be applied to a class of non-chemical specific discharges in a range of environmental settings. Also, the model is intended for use in real or threatened emergency spill situations, in addition to routine assessments for contingency planning, and thus the input data required is restricted to that information that can be readily observed, estimated or assumed

from on-scene observations or reports; use of extensive, detailed site specific data is precluded. Major assumptions and/or limitations that are incorporated in the model are summarized for review in the following paragraphs.

Heat sources and heat sinks are neglected and the assumption is made that the initial temperature of the spilled chemical and the receiving water body are nearly equal. Any initial unequal temperatures would ultimately come to equilibrium at a temperature very nearly equal to the temperature of the water into which the spill occurs because of the comparatively large thermal capacity of a receiving water body into which a large scale spill may occur. During the initial stages of dispersion, the difference in the temperatures of the spilled chemical and the receiving water could effect the rate of dispersion. The significance of this assumption depends on the type of chemical, and relative temperature ranges at which these are transported.

Temperature differences may also give rise to buoyancy effects.

Studies of these effects have been reported in the literature, many of these dealing with thermal discharges from power plants or waste water discharges through submerged outlets or distributed outfalls. In these cases, the discharge is lighter than the receiving water. The movement of the discharge as it rises creates secondary induced turbulent currents, and the rate of dispersion and manner in which it takes place are effected. The water dispersion model described in this report assumes that the spill occurs onto the surface of the waterway, and the effect of buoyancy has not been incorporated. Thus the model strictly is most appropriate for those

liquids that are neither significantly lighter nor denser than the receiving water. The model may also be applied for the dispersion of solid particles, if these are neutrally buoyant or if the settling times are large in comparison to the dispersion.

Chemical degradation in the aquatic environment has been modeled by a first order rate constant process, but degradation is ignored for field calculations. Additional effects of chemical reactions or phase changes during dispersion have not been incorporated. Phenomena associated with chemical reactions, and also neglected, include resulting dispersion of the products of reaction, and thermal effects from the heat of reaction. The most significant model assumption may be that no vapor is liberated, and, that other than a first order decay, the entire mass of spilled chemical is dispersed. The model assumes the chemical is fully soluble in water (miscible in all proportions), and that all the discharged chemical goes into solution with water. A separate model has been developed independently to estimate vaporization rates; however, the resulting reduction of the mass dispersing in water has not been incorporated. This assumption leads to estimates of concentrations in water that are conservative.

Stratification of the receiving water body, and the interaction with density or buoyancy effects have not been included, although the receiving water body is considered to be non-isotropic, with different but constant dispersion coefficients along each axis.

Strictly, the model applies to spills of large quantities that occur under assumed instantaneous or continuous discharge conditions; field

calculation procedures are developed only for instantaneous releases. For continuous discharges, the rate at which the chemical is released is assumed to be constant. An analysis of the continuous release model has formulated an approach in which a variable mass release rate can be modeled. However, as implemented, the model is limited to a constant release rate since for the purpose of expected use it was assumed that inadequate information would be available to accurately characterize a variable rate.

River channels are modeled as having a constant rectangular cross section, and a constant cross-sectional average river velocity has been assumed for non-tidal rivers. For tidal rivers, the tidal effect has been modeled by a sinusoidal velocity imposed on the non-tidal component. Velocity variations caused by winds, storms, local channel obstructions, and similar effects have not been included. The boundaries (banks and channel bottom) of the river channel have been assumed to be impenetrable to the dispersing mass, and only first order image sources have been included to model the effect of confined dispersion.

In regions near to the source for a continuous discharge into a river, the additional longitudinal travel due to longitudinal dispersion is neglected with respect to the bulk motion of the dispersing mass in the direction of river travel. This assumption is strictly applicable to rivers in which the rate of longitudinal diffusion is small with respect to the movement with the river velocity; however, all but the most slowly flowing rivers will give reasonably good agreement with this assumption.

At distances far from the location of a spill into a non-tidal river, a simplifying assumption is made that the dispersing mass reaches a uniform

cross-sectional distribution, and further dispersion occurs in a one-dimensional manner in the direction of river flow. While the assumption is reasonably consistent with the expected behavior of the mass at large distances from the spill, and introduces some simplicity in the model formulation, the resulting difference in the modeling equations may cause a discontinuity in concentration estimates between the "near" and "far" regions. Since the model incorporates, to a first order, the boundary effects in the region near the spill site, concentrations reached at long distances from the spill location should be expected to approximate those obtained by one-dimensional analysis, and as a result the one-dimensional analysis is not essential. The model does not currently include provision for automatically forcing a match between these near and far field equations, and the results obtained should instead be interpreted in terms of the type of dispersion being modeled.

Although some of these assumptions and limitations have greater effect than others, it is generally concluded that the assumptions lead to a simplified, but reasonably realistic, model with which estimates of concentration distributions can be obtained on the same order of accuracy as the accuracy to which the required model inputs are available.

# REFERENCES

- Hazard Assessment Handbook, CG-446-3, U.S. Coast Guard, January, 1974, Unclassified.
- 2. Potts, R. G., et. al., "Advanced Spill Model," Arthur D. Little, Inc.,
  Report ESL-TR-80-07 to U.S. Air Force, Headquarters Air Force Engineering
  and Service Center, Tyndall AFB, Florida, February 1980, Unclassified.

## APPENDIX A

# GRAPHS FOR CALCULATION PROCEDURE

The following 10 graphs are used with a simple calculation procedure described in Section II to determine the maximum downstream concentration in water of a soluble chemical which has spilled into a flowing stream. Each graph corresponds to a range of values for the stream width. Select the appropriate graph for the width of the stream into which the spill has occurred. For stream widths close to the limit of a range, select the graph for the smaller category for conservative results. The graphs and corresponding width intervals are:

Stream Width (feet)	Figure to be Used
0-75	A-1
75-200	A-2
200-400	A-3
400-800	A-4
800-1200	A-5
1200-1800	A-6
1800-2200	A-7
2200-2800	A-8
2800-3400	A-9
Greater than 3400	· A-10

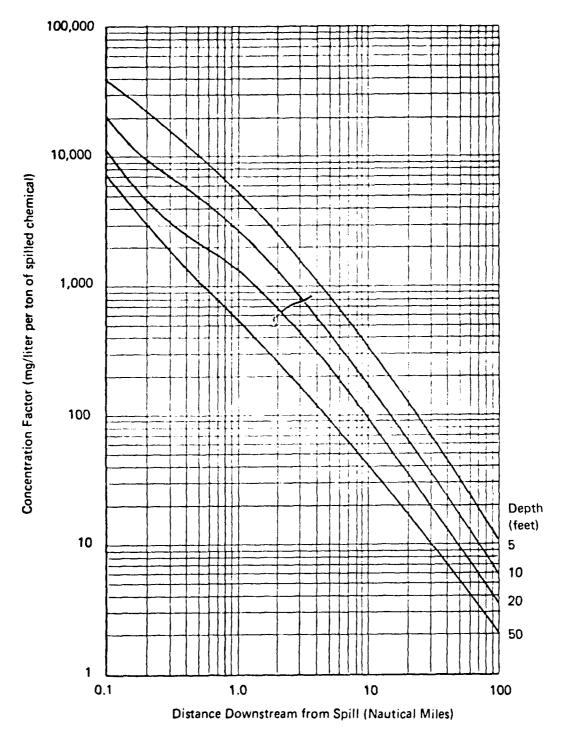
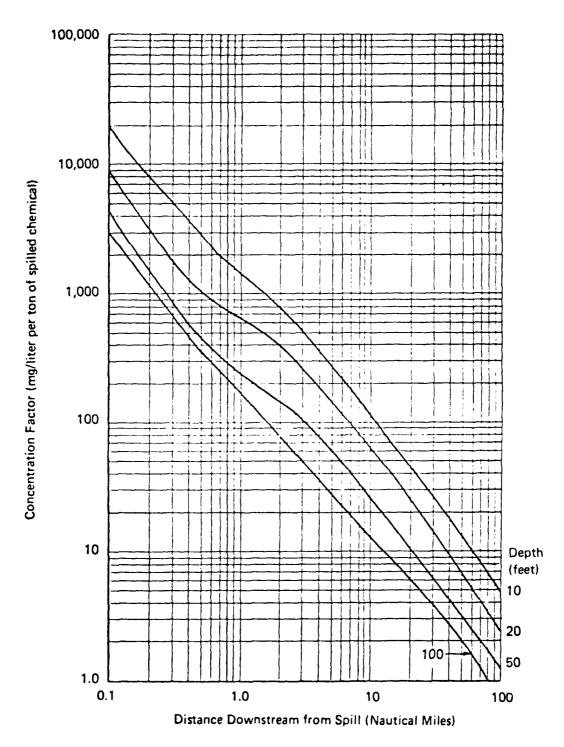


Figure A-1 Concentration Factor for Soluble Chemical in a Flowing Stream (Width Less than 75 Feet)



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Figure A-2 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 75 to 200 Feet)

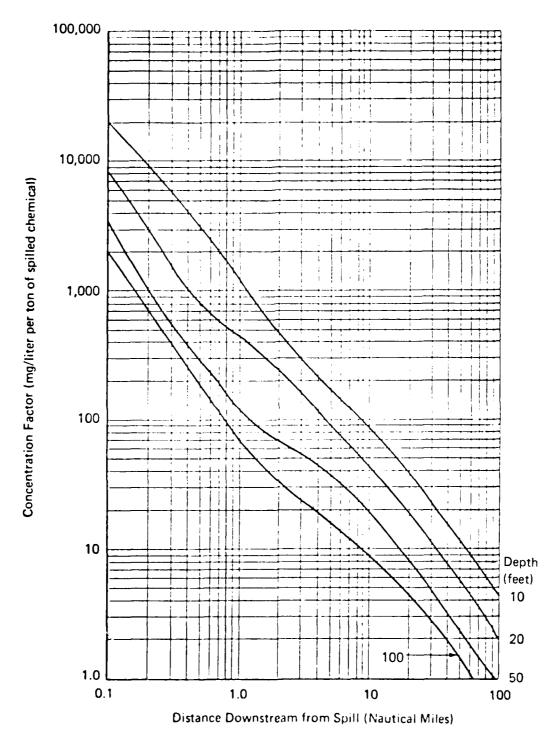


Figure A-3 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 200 to 400 Feet)

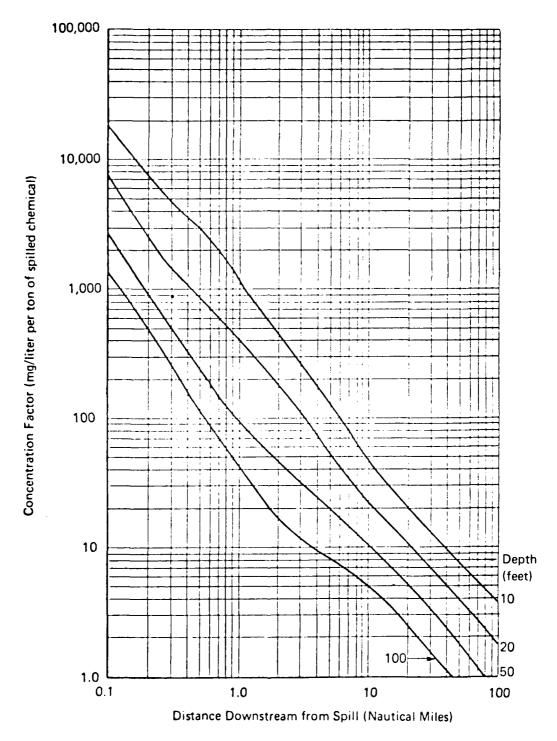


Figure A-4 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 400 to 800 Feet)

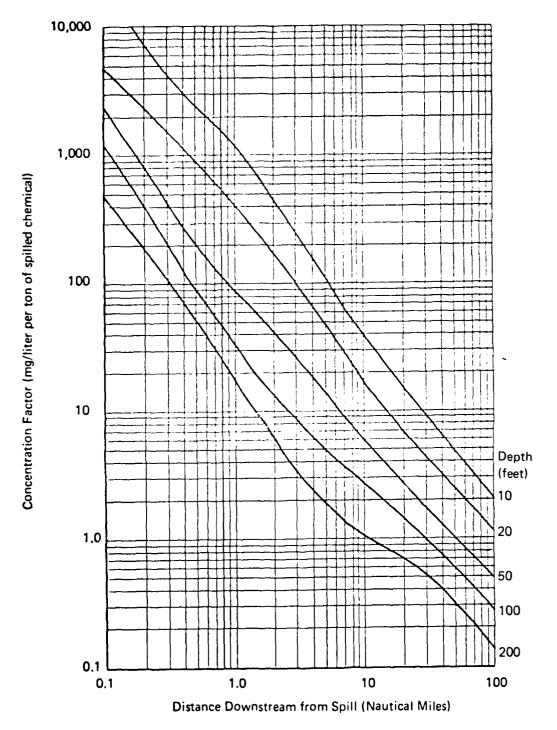


Figure A-5 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 800 to 1200 Feet)

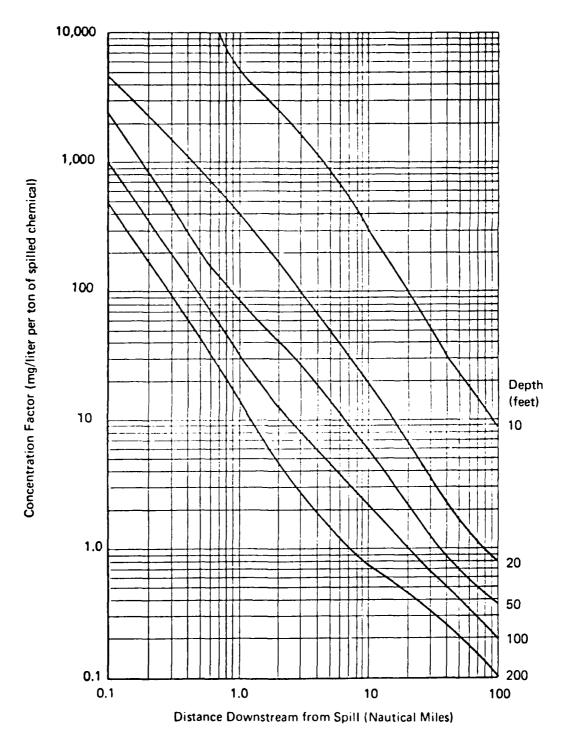


Figure A-6 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 1200 to 1800 Feet)

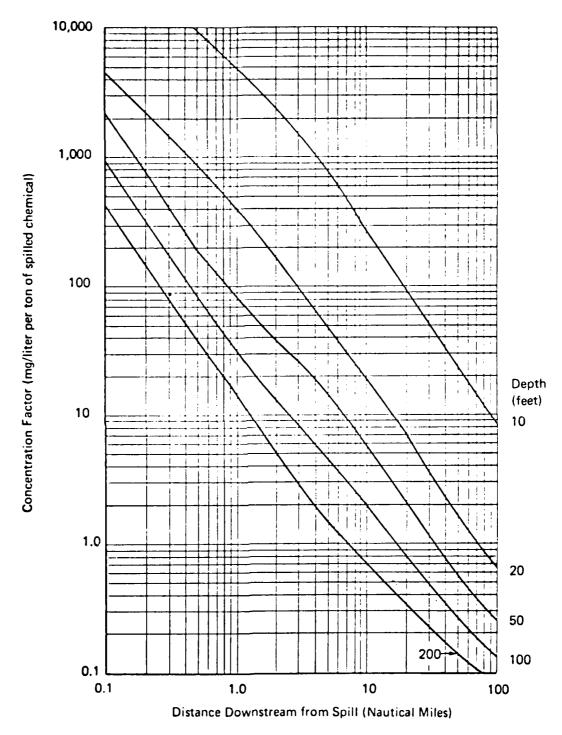


Figure A-7 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 1800 to 2200 Feet)

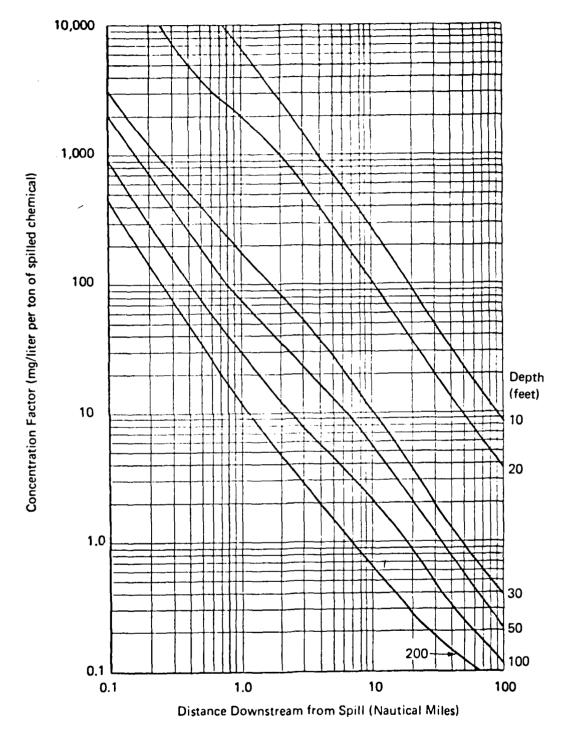


Figure A-8 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 2200 to 2800 Feet)

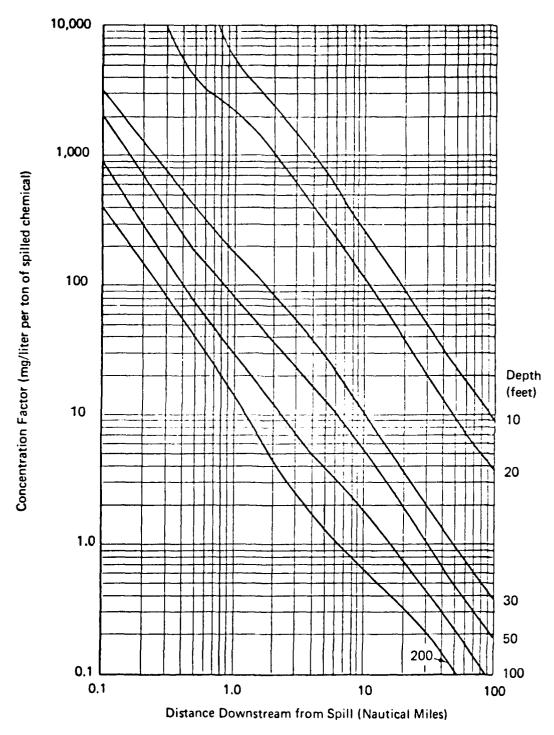


Figure A-9 Concentration Factor for Soluble Chemical in a Flowing Stream (Width 2800 to 3400 Feet)

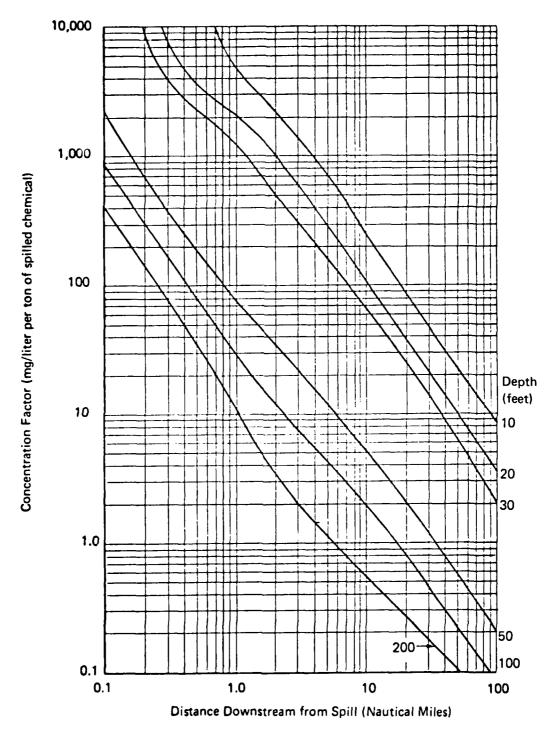


Figure A-10 Concentration Factor for Soluble Chemical in a Flowing Stream (Width Greater than 3400 Feet)

### APPENDIX B

## DATA TABLES

The following 10 tables contain values of the concentration factor tabulated for a range of values of stream width, stream depth, and distance downstream from the spill location. Concentration factors are given in units of mg/liter per ton of spilled chemical. Data contained in these tables were selected to prepare the graphs for the manual calculation procedure given in Appendix A. In some cases the tables also contain additional data points which could be useful for unusual channel geometries or as interpolation aids. Each table corresponds to a range of values for the stream width. Select the appropriate table for the width of the stream into which the spill has occurred. For stream widths close to the limit of a range, select the table for the smaller category for conservative results. The tables and corresponding width intervals are:

Stream Width (feet)	Table to be Used
0-75	B-1
75–200	B-2
200-400	B-3
400-800	B-4
800-1200	B-5
1200-1800	B-6
1800-2200	B <b>-</b> 7
2200-2800	B-8

Stream Width (feet)	Table to be Used
2800-3400	В-9
Creator than 3400	R-10

TABLE B-1. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH LESS THAN 75 FEET)

in Nautical							
			Rive	River Depth in Feet	ų		
Miles	5	10	20	20	20	100	200
0.1	57134.52	21624.49	12189.79	9561.02	7608.79	6247.53	5602.38
0.5	27509.54	9661.43	4910.59	4021.44	3356.94	2862.57	2613.18
0.3	17730.68	6998.40	3258.95	2620.75	2199.67	1874.31	1706.05
9.0	13186.28	5800.42	2575.82	1954.17	1619.68	1369.62	1240.31
0.5	10638.40	5032.73	2196.32	1561.60	1264.03	1060.88	956.49
0.6	8995.99	4453.31	1942.63	1306.80	1024.10	853.91	767.17
0.7	7826.53	3984.22	1751.88	1130.34	852.71	706.75	633.18
8.0	6935.47	3592.17	1597.94	1001.53	725.40	597.59	534.17
6.0	6224.80	3258.86	1468.42	903.16	628.08	513.92	458.53
1.0	5640.05	2972.39	1356.70	825.12	552.00	448.12	399.21
2.0	2747.48	1455.35	726.39	453.35	248.84	174.88	154.57
3.0	1697.61	892.07	464.22	304.09	166.21	99.01	86.82
4.0	1179.11	616.00	328.04	222.10	125.75	66.64	57.30
5.0	879.36	457.54	247.23	171.22	100.59	49.19	41.40
0.9	688.00	356.92	194.79	137.12	83.17	39.82	31.70
7.0	557.15	288.40	158.55	112.98	70.36	33.34	25.27
8.0	463.07	239.29	132.28	95.15	60.57	28.79	20.17
0.6	392.76	202.68	112.53	81.56	52.87	25.41	17.46
10.0	338.60	174.53	97.24	70.91	89.97	22.78	14.97
20.0	125.09	64.14	36.31	27.26	19.38	11.08	5.74
30.0	69.11	35.37	20.13	15.27	11.17	6.99	3.58
40.0	45.22	23.12	13.20	10.06	7.47	4.93	2.64
20.0	32.50	19.91	9.50	7.26	5.44	3.72	2.10
60.0	24.80	12.67	7.25	5.56	4.19	2.93	1.73
70.0	19.72	10.07	5.17	6.43	3.35	2.39	1.47
80.0	16.17	8.25	4.73	3.63	2.76	1.99	1.27
0.06	13.57	6.93	3.97	3.05	2.33	1.70	1.11
100.0	11.60	5.92	3.40	2.61	1.99	1.47	0.98

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-2. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 75 TO 200 FEET)

Distance Downstream from Spill in Naurical			Rive	River Deoth in Feet	ب			
Miles		10	20	93	20	100	200	
0.1	52987.27	18164.54	8813.32	6272.53	4378.12	3056.93	2436.37	
0.2	25224.65	8060.73	3174.18	2223.60	1562.50	1112.36	906.35	
0.3	15644.73	5284.67	1857.52	1242.15	890.09	659.05	552.18	
9.0	10912.18	3896.17	1349.94	861.38	622.72	474.99	403.78	
0.5	8166.55	3058.59	1097.95	678.92	484.28	374.73	320.00	
9.0	6411.21	2508.66	950.13	577.78	399.70	310.08	264.68	
0.7	5213.86	2127.49	852.00	514.64	342.42	264.06	224.83	
8.0	4358.55	1851.72	780.32	471.02	300.99	229.29	194.57	
6.0	3725.85	1644.60	724.02	438.24	269.68	201.96	170.17	
1.0	3244.58	1483.80	617.42	411.91	245.23	179.88	151.57	
2.0	1433.13	785.46	410.89	263.01	140.12	79.49	62.09	
3.0	948.35	530.34	281.71	185.69	101.52	48.66	38.07	
0.4	708.09	390.81	207.37	139.03	78.74	35.16	25.67	
5.0	559.45	303.48	160.44	108.75	63.43	27.85	18.80	
0.9	457.73	244.41	128.75	87.93	52.48	23.24	14.55	
7.0	383.90	202.27	106.20	72.94	44.33	20.02	11.73	
8.0	328.13	170.96	89.52	61.74	38.08	17.59	9.75	
9.0	284.73	146.96	76.17	53.13	33.16	15.68	8.30	
10.0	250.13	128.08	66.78	46.34	29.50	14.13	7.22	
20.0	101.27	49.80	25.70	18.06	11.94	69.9	3.21	
30.0	57.83	28.01	14.40	10.16	6.84	4.09	2.12	
40.0	38.49	18.49	67.6	6.71	4.56	2.82	1.57	
50.0	27.95	13.37	6.85	4.85	3.31	2.10	1.23	
0.09	21.47	10.24	5.24	3.71	2.54	1.64	1.00	
70.0	17.16	8.16	4.18	2.96	2.03	1.32	0.84	
80.0	14.12	6.70	3.43	2.43	1.67	1.10	0.71	
90.0	11.88	5.63	2.88	2.04	1.41	0.93	0.61	
100.0	10.18	4.82	2.46	1.75	1.21	0.80	0.54	

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-3. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 200 TO 400 FEET)

Distance Downstream from Spill in Naurical			a	River Denth in Toot				
Miles	5	10	20	30	20	100	200	ı
0.1	50889.12	16523.48	7271.28	4838.61	3055,59	1840.69	1284.72	
0.5	24137.06	7469.54	2652.83	1713.62	1080.31	620.79	454.29	
0.3	14917.93	4895.61	1577.93	947.91	588.14	354.48	248.15	
0.4	10382.02	3588.55	1139.89	640.12	382.67	231.22	163.43	
0.5	7756.44	2787.64	900.11	484.07	275.64	167.33	120.15	
9.0	6077.12	2249.10	744.94	391.99	212.81	129.81	94.90	
0.7	4926.93	1865.06	634.42	331.54	173.06	105.81	78.68	
0.8	4098.69	1579.44	551.06	288.75	146.54	89.43	97.49	
0.0	3478.97	1360.08	485.84	256.83	128.08	77.63	59.23	
1.0	3001.06	1187.28	433.54	232.11	114.75	68.78	52.89	
2.0	1112.48	472.04	207.66	129.25	68.92	34.03	25.53	
3.0	619.22	281.84	141.57	95.01	54.12	23.98	16.15	
4.0	414.04	202.74	109.15	75.28	44.31	19.14	11.44	
5.0	308.67	160.17	88.79	61.19	37.04	16.12	8.71	
0.9	246.75	133.12	74.45	51.92	31.46	13.96	86.9	
7.0	206.53	114.03	63.72	04.40	27.10	12.28	5.81	
8.0	178.31	99.64	55.38	38.52	23.64	10.94	4.99	
9.0	157.31	88.30	48.73	33.82	20.83	9.82	4.38	
10.0	140.94	79.10	43.32	30.00	18.53	8.89	3.92	
20.0	68.04	36.03	18.61	12.69	7.94	4.20	1.98	
30.0	42.71	21.64	10.87	7.36	4.62	2.54	1.31	
40.0	30.01	14.80	7.32	4.93	3.10	1.74	0.95	
20.0	22.57	10.93	5.35	3.60	2.26	1.29	0.74	
0.09	17.76	8.49	4.13	2.77	1.75	1.00	0.59	
70.0	14.45	6.85	3.31	2.22	1.40	0.81	67.0	
80.0	12.05	2.67	2.73	1.83	1.15	0.67	0.41	
90.0	10.25	4.80	2.30	1.54	0.97	0.57	0.35	
100.0	8.86	4.12	1.98	1.32	0.83	0.49	0.31	

Concentration factors are given in units of mg/liter per ton of spilled chemical. Note:

TABLE B-4. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 400 TO 800 FEET)

Distance Downstream from Spill			i	- - - -				
Miles	5	01	20	Aiver Depth in reet	20	100	200	1
0.1	49850.16	15723.46	6524.59	4151.13	2432.86	1284.72	773.91	
0.5	23589.12	7173.39	2404.42	1472.60	860.15	454.22	273.62	
0.3	14553.01	4698.84	1449.38	821.55	468.44	247.24	148.94	
0.4	10116.68	3437.21	1054.59	561.55	305.33	160.59	96.74	
0.5	7552.58	2664.93	834.74	429.08	220.63	114.91	69.22	
9.0	5914.29	2146.70	690.76	349.73	170.81	87.42	52.67	
0.7	4793.05	1777.86	587.44	296.50	138.93	69.38	41.83	
8.0	3986.12	1504.01	509.09	257.85	117.16	56.82	34.28	
0.0	3382.62	1293.98	647.45	228.18	101.52	47.67	28.81	
1.0	2917.38	1128.70	397.68	204.51	89.78	40.79	24.70	
2.0	1080.07	441.09	172.24	95.49	43.18	16.19	9.82	
3.0	597.17	248.60	101.24	58.75	28.92	11.16	6.30	
4.0	390.93	164.37	68.83	41.55	22.16	9.22	4.74	
5.0	281.05	118.97	51.22	32.13	18.27	8.09	3.86	
6.0	214.49	91.38	40.59	26.35	15.69	7.27	3.30	
7.0	170.61	73.25	33.64	22.47	13.80	9.60	2.91	
8.0	139.93	60.68	28.81	19.61	12.33	6.03	2.62	
9.0	117.51	51.60	25.28	17.54	11.14	5.53	2.39	
10.0	100.57	44.81	22.58	15.85	10.14	5.09	2.20	
20.0	38.16	19.87	11.15	7.92	5.05	2.63	1.24	
30.0	23.62	13.07	7.22	5.02	3.14	1.65	0.83	
40.0	17.38	9.62	5.18	3.54	2.19	1.15	09.0	
50.0	13. 79	7.54	3.95	2.67	1.63	0.86	97.0	
0.09	11.40	6.12	3.14	2.10	1.28	0.68	0.37	
70.0	99.6	5.10	2.57	1.71	1.04	0.55	0.30	
80.0	8.35	4.33	2.16	1.43	98.0	97.0	0.25	
0.06	7.31	3.74	1.84	1.22	0.73	0.39	0.22	
100.0	6.48	3.27	1.60	1.05	0.63	0.33	0.19	

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-5. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 800 TO 1200 FEET)

Distance Downstream

in Nautical			Rive	River Depth in Fee			
Miles	<b>v</b> i	10	20	30	50	100	(E)
0.1	288993.09	15328.65	6157.96	3815.55	2132.66	1022.89	\$40.16
0.7	136598.28	7025.00	2283.37	1355.45	754.03	361.65	190.97
0.3	84195.48	4599.63	1386.27	760.58	410.85	196.86	103.95
0.4	58496.22	3360.91	1012.12	523.62	268.39	127.86	67.52
0.5	43653.79	2603.16	801.85	402.34	194.78	67.16	48.31
9.0	34175.47	2095.22	663.35	329.08	151.66	19.69	36.75
0.7	27691.00	1734.09	563.70	279.50	124.09	55.27	29.17
9.0	23025.64	1466.20	488.07	243.23	105.23	45.29	23.87
0.0	19537.24	1260.90	428.57	215.25	91.60	38.04	20.01
1.0	16848.48	1099.44	380.56	192.84	81.31	32.59	17.08
2.0	6234.80	428.88	163.88	89.32	39.14	12.84	6.05
3.0	3446.66	241.56	95.97	54.28	25.14	8.17	3.36
0.4	2256.15	159.64	64.75	37.39	17.98	6.07	2.31
5.0	1621.95	115.43	47.42	27.75	13.69	4.84	1.81
0.9	1237.72	88.43	36.64	21.64	10.89	70.7	1.53
7.0	984.40	70.53	29.40	17.49	8.95	3.48	1.36
8.0	807.08	57.94	24.27	14.52	7.54	3.08	1.24
9.0	677.26	48.70	20.48	12.31	67.9	2.76	1.15
10.0	578.86	41.68	17.58	10.62	5.69	2.52	1.08
20.0	205.62	14.91	6.54	4.23	2.60	1.40	0.70
30.0	112.10	8.25	3.89	2.68	1.74	96.0	0.50
40.0	72.87	5.54	2.81	1.99	1.30	0.72	0.37
50.0	52.17	4.17	. 22	1.58	1.03	95.0	0.29
0.09	39.70	3.36	.84	1.31	0.84	0.45	0.24
70.0	31.51	2.83	1.57	1.11	0.71	0.37	0.20
0.08	25.79	2.45	1.36	96.0	0.60	0.12	0.17
0.06	21.62	2.17	1.20	0.84	0.52	0.27	0.14
100.0	18.46	1.94	1.07	0.74	97.0	0.24	0.13

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-6. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 1200 TO 1800 FEET)

Distance Downstream from Spill			2 2	River Dooth in Fee				
Miles	5	10	20	200	50	100	200	
-	287964.75	89044.62	6036.79	3704.97	2034.38	938.38	466.21	
	136060.22	40869.63	2243.50	1316.94	719.29	331.77	164.83	
7.0	83838.08	26754.95	1365.39	740.61	392.02	180.59	89.72	
4.0	58236.85	19542.16	997.97	511.18	256.35	117.30	58.28	
	43454.77	15131.04	790.84	393.53	186.39	83.94	41.70	
	34016.65	12175.25	654.15	322.23	145.45	63.87	31.72	
2.0	27560.52	10074.48	555.73	273.83	119.27	50.72	25.17	
. α . c	22915.98	8516.62	481.00	238.33	101.34	41.59	20.60	
	19463.43	7323.04	422.23	210.90	88.36	34.96	17.27	
0.5	16767.04	6384.52	374.81	188.91	78.53	29.98	14.74	
2.0	6203.73	2489.05	161.09	87.27	37.85	12.00	5.23	
2	3429.31	1401.61	94.26	52.94	24.26	7.69	2.91	
0.4	2244.73	926.17	63.56	36.43	17.31	5.70	1.98	
5.0	1613.71	669.64	46.53	27.02	13.16	4.51	1.51	
9	1231.42	512.97	35.95	21.06	10.44	7. 70	1.23	
7.0	979.39	409.11	28.85	17.01	8.54	3.12	1.05	
0.8	802.96	336.11	23.81	14.11	7.16	2.68	0.93	
0.6	673.80	282.50	20.09	11.95	6.11	2.33	0.83	
10.0	575.90	241.77	17.24	10.29	5.30	2.06	0.76	
20.0	204.57	86.39	6.24	3.79	2.05	0.95	0.45	
0.05	111.53	47.19	3.44	2.13	1.22	0.64	6.3	
0.07	72.50	30.71	2.27	1.45	0.88	0.49	0.26	
0.05	51.90	21.99	1.67	1.10	0.70	0.39	0.21	
0.09	39.49	16.74	1.32	06.0	0.58	0.32	0.18	
20.0	31.35	13.29	1.10	0.76	67.0	0.28	0.15	
80.0	25.66	10.88	0.94	0.66	0.43	0.24	0.13	
0.06	21.51	9.12	0.83	0.58	0.38	0.21	0.11	
100.0	18.37	7.79	0.74	0.52	0.34	0.18	0.10	

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-7. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 1800 TO 2200 FEET)

Distance Downstream from Spill in Nautical			Rive	River Depth in Feet			
Miles	21	10	20	30	20	100	200
0.1	287278.87	88534.85	5956.32	3631.61	1969.39	882.86	418.16
0.2	135701.25	40676.08	2217.05	1291.43	696.31	312.14	147.84
0.3	83599.73	26625.09	1351.51	727.40	379.58	169.91	80.48
7.0	58063.89	19442.29	988.54	502.94	248.41	110.36	52.27
0.5	43322.09	15050.27	783.48	387.67	180.86	78.97	37.40
9.0	33910.79	12108.01	648.00	317.67	141.36	60.10	28.45
0.7	27473.54	10017.36	550.40	270.04	116.10	47.74	22.58
8.0	22842.90	8467.32	476.28	235.06	98.78	39.16	18.48
6.0	19380.90	7279.92	417.99	208.00	86.22	32.94	15.49
1.0	16712.76	6346.41	370.97	186.29	76.68	28.27	13.22
2.0	6183.02	2473.19	159.23	85.89	36.99	11.45	4.70
3.0	3417.74	1392.47	93.12	52.05	23.66	7.37	2.63
0.4	2237.12	920.06	62.17	35.80	16.86	2.46	1.81
5.0	1608.22	665.20	45.95	26.54	12.81	4.31	1.39
0.9	1227.23	509.55	35.49	20.68	10.15	3.54	1.13
7.0	976.05	406.37	28.48	16.70	8.30	2.97	96.0
8.0	800.22	333.86	23.50	13.85	96.9	2.55	0.84
9.0	671.50	280.61	19.82	11.72	5.94	2.21	0.74
10.0	573.93	240.14	17.02	10.09	5.14	1.95	0.66
20.0	203.87	85.80	6.16	3.71	1.95	08.0	0.32
30.0	111.15	46.87	3.38	2.04	1.09	0.47	0.22
40.0	72.25	30.50	2.20	1.34	0.72	0.34	0.17
50.0	51.72	21.84	1.58	96.0	0.53	0.26	0.14
0.09	39.36	16.63	1.21	0.74	0.42	0.22	0.12
70.0	31.24	13.20	96.0	09.0	0.35	0.19	0.10
80.0	25.57	10.81	0.79	0.50	0.30	0.16	0.0
0.06	21.43	90.6	0.67	0.43	0.26	0.14	0.08
100.0	18,30	7.74	0.58	0.37	0.23	0.13	0.07

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-8. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 2200 TO 2800 FEET)

M.1.6s         5         10         20         30         50         100         200           0.1         287029.34         88349.72         34727.20         3605.01         1945.86         862.84         400.95           0.2         135570.69         40605.68         12933.60         1282.18         688.00         305.06         141.76           0.3         88010.02         19405.93         5771.83         499.95         245.54         107.86         70.16           0.4         4273.85         19405.93         5771.83         499.95         245.44         305.06         141.76           0.6         33871.31         12082.87         389.65         371.84         499.95         245.74         372.14         37.88         37.14         37.21           0.7         27441.93         278.46         37.24         27.88         38.74         37.21         44.77           0.9         12336.18         7244.28         278.44         32.21         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66         44.66 <th>Distance Downstream from Spill in Nautical</th> <th></th> <th></th> <th>River</th> <th>River Depth in Feet</th> <th>ىي</th> <th></th> <th></th> <th></th>	Distance Downstream from Spill in Nautical			River	River Depth in Feet	ىي			
287029.34         88349.72         34727.20         3605.01         1945.86         862.84           13550.69         40605.68         12933.60         1282.18         688.00         305.06           3313.04         26577.82         771.83         499.95         170.86         171.86           58001.02         19405.87         777.83         499.95         245.54         107.86           4373.85         15020.87         4574.76         385.55         178.86         77.18           3373.3         12083.55         3783.56         114.95         85.44         37.18           22816.33         8449.38         2780.48         233.87         97.85         38.78           1938.18         7264.25         2449.98         206.94         85.44         32.21           1659.03         246.43         92.80         85.39         36.68         11.25           1659.10         4313.54         1389.15         54.316         51.73         32.45         7.25           4175.50         2465.34         92.80         86.39         36.68         11.70         3.48           4175.50         2467.34         92.80         86.39         36.44         32.45         3.48 <th>Miles</th> <th>5</th> <th>10</th> <th>20</th> <th>30</th> <th></th> <th>100</th> <th>200</th> <th></th>	Miles	5	10	20	30		100	200	
135570.69         40605.68         12933.60         1282.18         688.00         305.06           83513.04         26577.82         7789.06         772.61         375.08         166.05           89513.04         19405.95         772.61         375.08         166.05           58001.02         19405.95         377.78         4574.76         385.55         178.86         77.18           4377.85         15020.87         4574.76         385.55         178.86         77.18         166.05           27441.93         996.98         3783.56         248.66         114.95         46.66         58.74           2786.31         7264.25         2439.98         206.94         85.44         32.21         46.66         47.14         32.21         46.66         47.14         32.21         46.66         47.14         32.21         46.66         47.14         32.21         46.66         47.14         32.21         46.66         48.24         32.21         46.66         47.24         32.21         46.66         47.24         32.21         46.66         47.24         32.21         46.66         47.24         32.24         47.24         47.24         47.24         47.24         47.24         47.24 <td< td=""><td>0.1</td><td>287029.34</td><td>88349.72</td><td>34727.20</td><td>3605.01</td><td>1945.86</td><td>862.84</td><td>400.95</td><td></td></td<>	0.1	287029.34	88349.72	34727.20	3605.01	1945.86	862.84	400.95	
83513.04         26577.82         7889.06         722.61         375.08         166.05           83513.04         26577.82         5771.83         499.95         245.54         107.86           43273.85         15020.87         5771.83         499.95         245.54         107.86           43273.81         15020.87         3783.46         316.01         139.88         58.74           27441.93         996.59         3213.42         268.66         114,95         46.66           27441.93         996.59         3213.42         268.66         114,95         46.66           27441.93         996.59         3213.42         268.66         114,95         46.66           2786.41         378.18         278.66         114,95         46.66         46.66           6175.50         2467.43         928.96         85.39         36.88         11.25           3413.54         1389.15         243.16         51.73         23.45         77.25           3413.54         1389.15         246.11         35.56         116.70         37.86           410.52         466.16         16.06         16.58         8.22         3.48           11.01         46.75         113.0	0.5	135570.69	40605.68	12933.60	1282.18	688.00	305.06	141.76	
\$8001.02         19405.95         \$771.83         \$499.95         \$245.54         107.86           \$4373.85         15020.87         \$474.76         385.55         178.86         77.18           \$3872.31         12083.55         373.47         385.55         178.86         77.18           \$2744.193         9996.59         3213.42         268.66         114.95         46.66           \$22816.33         8449.38         2780.48         233.87         97.85         38.74           \$22816.33         8449.38         2780.48         206.94         85.44         33.21           \$165.50         2467.43         928.96         85.39         36.68         11.25           \$165.50         2467.43         928.96         85.39         36.68         11.25           \$155.60         1389.15         543.16         33.45         7.25           \$131.54         1389.15         543.16         35.56         16.70         5.38           \$166.61         20.54         10.05         3.48         7.25           \$125.70         508.31         206.94         85.39         36.68         11.25           \$125.70         508.31         206.94         85.39         36.68 </td <td>0.3</td> <td>83513.04</td> <td>26577.82</td> <td>7889.06</td> <td>722.61</td> <td>375.08</td> <td>166.05</td> <td>77.16</td> <td></td>	0.3	83513.04	26577.82	7889.06	722.61	375.08	166.05	77.16	
43273.85         15020.87         4574.76         385.55         178.86         77.18           33872.31         12083.55         3783.56         316.01         199.88         58.74           2244.19         99.59         2780.48         23.87         46.66           22816.33         8449.38         2780.48         233.87         97.85         46.66           22816.33         8449.38         2780.48         206.94         85.44         32.21           16693.03         6332.56         2165.33         185.33         56.68         11.25           16693.03         633.56         2165.33         185.33         36.68         11.25           6175.60         2467.43         928.96         85.39         36.68         11.25           2234.36         1389.15         543.16         51.73         23.45         7.25           2234.36         663.58         267.96         26.36         16.70         5.38           1606.23         663.58         266.36         11.68         4.24         3.48           1606.24         363.51         36.11         3.48         7.25           1606.25         463.58         266.96         26.36         16.70	9.0	58001.02	19405.95	5771.83	499.95	245.54	107.86	50.12	
33872.31         12083.55         3783.56         316.01         139.88         58.74           27441.93         9996.59         3213.42         268.66         114.95         46.66           22461.33         2780.48         233.87         99.785         38.28           1938.18         7264.25         2439.98         206.94         85.44         32.21           16693.03         633.56         2165.33         185.33         76.01         27.66           6175.50         2467.43         928.96         85.39         36.68         11.25           3413.54         1389.15         543.16         51.73         23.45         7.25           2234.36         917.85         366.11         35.56         16.70         5.38           1606.23         663.58         267.96         26.36         12.68         4.24           1255.70         568.31         206.36         16.58         8.22         2.92           1606.46         135.04         137.05         113.75         6.88         2.25           1792.21         333.04         115.60         11.64         5.87         2.17           1711.01         46.75         19.70         2.03         1.00 <td>0.5</td> <td>43273.85</td> <td>15020.87</td> <td>4574.76</td> <td>385.55</td> <td>178.86</td> <td>77.18</td> <td>35.86</td> <td></td>	0.5	43273.85	15020.87	4574.76	385.55	178.86	77.18	35.86	
27441.93         9996.59         3213.42         268.66         114.95         46.66           22816.33         8449.38         2780.48         233.87         97.85         38.28           19358.18         7264.25         243.99         206.94         85.44         32.21           16633.03         6332.56         2165.33         76.01         27.66           6175.50         246.43         928.96         85.39         36.88         11.25           3413.54         1389.15         543.16         51.73         23.45         7.25           3413.54         1389.15         543.16         51.73         23.45         7.25           3613.56         267.96         85.39         36.68         11.25           1606.23         56.31         267.96         16.76         5.38         11.25           1606.24         36.11         35.56         16.70         5.38         4.24           125.70         508.31         267.96         26.36         10.05         5.38           160.65         279.22         115.60         11.54         5.87         2.17           573.21         239.55         10.02         1.03         1.01         0.73	9.0	33872.31	12083.55	3783.56	316.01	139.88	58.74	27.28	
22816.33         8449.38         2780.48         233.87         97.85         38.28           1938.18         7264.25         2439.98         206.94         85.44         32.21           16693.03         633.56         246.43         928.96         85.44         32.21           16693.03         246.43         928.96         85.39         36.68         11.25           3413.54         1389.15         543.16         51.73         23.45         7.25           2234.36         917.85         36.11         35.56         16.70         5.38           1606.23         663.58         267.96         26.36         16.70         5.38           1606.24         366.11         35.56         16.70         5.38           1606.25         267.96         26.36         16.70         5.38           1606.25         33.04         137.05         16.58         2.22         2.92           799.22         33.04         137.05         11.64         5.87         2.17           670.66         279.92         115.60         11.64         5.87         2.17           573.21         239.55         99.21         1.07         0.73         0.71	0.7	27441.93	9996.59	3213.42	268.66	114.95	46.66	21.65	
1938.18         7264.25         2439.98         206.94         85.44         32.21           16693.03         633.56         2165.33         185.33         76.01         27.66           6175.50         2467.43         928.96         885.39         36.68         11.25           3413.54         1380.15         543.16         51.73         23.45         17.25           3234.36         917.85         366.11         35.56         16.70         5.38           1606.23         663.58         267.96         26.36         16.70         5.38           1606.23         663.58         267.96         26.36         10.05         3.48           1606.24         366.11         35.56         10.05         3.48           1606.25         267.96         26.36         10.05         3.48           1606.27         33.04         137.05         10.05         3.48           1707.66         16.66         16.58         2.50         1.91           1701.67         279.55         19.21         10.02         5.87         2.17           111.01         46.75         11.86         1.32         0.71         0.71           111.01         46.75	8.0	22816.33	8449.38	2780.48	233.87	97.85	38.28	17.72	
16693.03         6332.56         2165.33         185.33         76.01         27.66           6175.50         246.43         928.96         85.39         36.68         11.25           3413.54         1389.15         543.16         51.73         23.45         7.25           224.36         91.85         364.11         35.56         16.70         5.38           1606.23         663.58         267.96         26.36         16.76         5.38           1606.23         663.58         267.96         26.36         10.05         3.48           97.83         405.38         166.06         16.58         8.22         2.92           97.83         405.38         166.06         11.65         8.82         2.50           670.66         270.53         11.65         8.82         2.50         2.92           670.66         270.92         115.60         11.64         5.87         2.17           670.66         270.92         11.60         5.09         1.91         2.50           670.67         11.60         2.83         1.91         0.78         0.78           72.16         270.21         1.74         0.71         0.71         0.18 <td>6.0</td> <td>19358.18</td> <td>7264.25</td> <td>2439.98</td> <td>206.94</td> <td>85.44</td> <td>32.21</td> <td>14.85</td> <td></td>	6.0	19358.18	7264.25	2439.98	206.94	85.44	32.21	14.85	
6175.50         2467.43         928.96         85.39         36.68         11.25           3413.54         1389.15         543.16         51.73         23.45         7.25           2234.36         138.11         35.56         16.70         5.38           1606.23         663.58         266.98         26.36         12.68         4.24           1225.70         508.31         206.98         20.54         10.05         3.48           974.83         465.66         15.6         16.58         8.22         2.92           99.22         33.04         137.05         13.75         6.88         2.50           670.66         279.52         115.60         11.64         5.87         2.17           670.67         279.51         115.60         11.64         5.87         2.17           670.66         279.52         115.60         11.64         5.87         2.17           573.21         239.55         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           51.66         21.79         9.22         0.95         0.51         0.18	1.0	16693.03	6332.56	2165.33	185.33	76.01	27.66	12.68	
3413.54         1389.15         543.16         51.73         23.45         7.25           2234.36         917.85         366.11         35.56         16.70         5.38           1606.23         663.58         267.96         26.36         16.70         5.38           1606.23         663.58         267.96         20.54         10.05         3.48           974.83         405.38         166.06         16.58         8.22         2.92           799.22         33.04         137.05         13.75         6.88         2.50           670.66         279.92         115.60         11.64         5.87         2.17           573.21         239.55         99.21         10.02         5.87         2.17           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.00         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.23           31.20         13.17         5.88         0.73         0.18           39.31         16.59         7.02         0.73         0.18           25.54         10.	2.0	6175.50	2467.43	928.96	85.39	36.68	11.25	4.51	
2234.36         917.85         366.11         35.56         16.70         5.38           1606.23         663.58         267.96         26.36         12.68         4.24           1125.70         508.31         266.98         26.36         12.68         4.24           97.83         465.38         166.66         16.58         8.25         2.92           799.22         33.04         137.05         13.75         6.88         2.50           670.66         279.92         115.60         11.64         5.87         2.17           577.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.31           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.18         0.18           21.41         9.04         3.83         0.40         0.23         0.11	3.0	3413.54	1389.15	543.16	51.73	23.45	7.25	2.53	
1606.23         663.58         267.96         26.36         12.68         4.24           1225.70         508.31         206.98         20.54         10.05         3.48           994.83         166.06         16.58         10.05         3.48           799.22         33.04         137.05         13.75         6.88         2.50           670.66         279.92         115.60         11.64         5.87         2.17           203.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.31           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           21.41         9.04         3.83         0.48         0.27         0.11           21.41         9.04         3.83         0.40         0.20         0.11           18.28 <td< td=""><td>6.0</td><td>2234.36</td><td>917.85</td><td>366.11</td><td>35.56</td><td>16.70</td><td>5.38</td><td>1.74</td><td></td></td<>	6.0	2234.36	917.85	366.11	35.56	16.70	5.38	1.74	
1225.70         508.31         206.98         20.54         10.05         3.48           94.83         405.38         166.06         16.58         8.22         2.92           799.22         33.04         137.05         137.75         6.88         2.59           670.66         279.92         115.60         11.64         5.87         2.17           203.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.45           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           21.41         9.04         3.83         0.40         0.23         0.11           21.41         9.04         3.83         0.40         0.20         0.11           21.41         9.04         3.83         0.35         0.20         0.11	5.0	1606.23	663.58	267.96	26.36	12.68	4.24	1.34	
974.83         465.66         16.58         8.22         2.92           799.22         333.04         137.05         13.75         6.88         2.92           670.66         279.92         115.60         11.64         5.87         2.17           573.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.31           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           39.31         16.59         7.02         0.73         0.39         0.16           25.54         10.78         4.57         0.40         0.23         0.15           21.41         9.04         3.83         0.40         0.20         0.11           18.28         7.72         3.27         0.35         0.01         0.11	0.9	1225.70	508.31	206.98	20.54	10.05	3.48	1.10	
799.22         333.04         137.05         13.75         6.88         2.50           670.66         279.92         115.60         11.64         5.87         2.17           573.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.45           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           31.20         13.17         5.58         0.58         0.32         0.16           25.54         10.78         4.57         0.40         0.27         0.11           18.28         7.72         3.27         0.35         0.20         0.11	7.0	974.83	405.38	166.06	16.58	8.22	2.92	0.93	
670.66         279.92         115.60         11.64         5.87         2.17           577.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         16.02         5.09         1.91           111.01         46.75         19.70         2.03         1.07         0.45           72.16         21.79         9.22         0.95         0.71         0.31           39.31         16.59         7.02         0.73         0.21         0.23           31.20         13.17         5.58         0.78         0.18           25.54         10.78         4.57         0.48         0.27         0.11           21.41         9.04         3.83         0.40         0.23         0.12           18.28         7.72         3.27         0.35         0.11	8.0	799.22	333.04	137.05	13.75	6.88	2.50	0.81	
573.21         239.55         99.21         10.02         5.09         1.91           203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.45           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           31.20         13.17         5.58         0.58         0.39         0.16           25.54         10.78         4.57         0.48         0.27         0.13           21.41         9.04         3.83         0.40         0.23         0.12           18.28         7.72         3.27         0.35         0.12         0.11	9.0	99.029	279.92	115.60	11.64	5.87	2.17	0.72	
203.61         85.59         35.91         3.68         1.92         0.78           111.01         46.75         19.70         2.03         1.07         0.45           72.16         30.42         12.85         1.33         0.71         0.45           71.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           25.54         10.78         4.57         0.48         0.27         0.16           21.41         9.04         3.83         0.40         0.23         0.12           18.28         7.72         3.27         0.35         0.20         0.11	10.0	573.21	239.55	99.21	10.02	5.09	1.91	0.64	
111.01     46.75     19.70     2.03     1.07     0.45       72.16     30.42     12.85     1.33     0.71     0.31       51.66     21.79     9.22     0.95     0.51     0.31       39.31     16.59     7.02     0.73     0.39     0.18       25.54     10.78     4.57     0.48     0.27     0.16       21.41     9.04     3.83     0.40     0.23     0.12       18.28     7.72     3.27     0.35     0.20     0.11	20.0	203.61	85.59	35.91	3.68	1.92	0.78	0.30	
72.16         30.42         12.85         1.33         0.71         0.31           51.66         21.79         9.22         0.95         0.51         0.23           39.31         16.59         7.02         0.73         0.39         0.18           31.20         13.17         5.58         0.58         0.32         0.16           25.54         10.78         4.57         0.48         0.27         0.13           21.41         9.04         3.83         0.40         0.23         0.12           18.28         7.72         3.27         0.35         0.20         0.11	30.0	111.01	46.75	19.70	2.03	1.07	0.45	0.19	
51.66     21.79     9.22     0.95     0.51     0.23       39.31     16.59     7.02     0.73     0.39     0.18       31.20     13.17     5.58     0.58     0.32     0.16       25.54     10.78     4.57     0.48     0.27     0.13       21.41     9.04     3.83     0.40     0.23     0.12       18.28     7.72     3.27     0.35     0.20     0.11	40.0	72.16	30.42	12.85	1.33	0.71	0.31	0.14	
39.31     16.59     7.02     0.73     0.39     0.18       31.20     13.17     5.58     0.58     0.32     0.16       25.54     10.78     4.57     0.48     0.27     0.13       21.41     9.04     3.83     0.40     0.23     0.12       18.28     7.72     3.27     0.35     0.20     0.11	50.0	51.66	21.79	9.22	0.95	0.51	0.23	0.11	
31.20     13.17     5.58     0.58     0.32     0.16       25.54     10.78     4.57     0.48     0.27     0.13       21.41     9.04     3.83     0.40     0.23     0.12       18.28     7.72     3.27     0.35     0.20     0.11	0.09	39.31	16.59	7.02	0.73	0.39	0.18	0.10	
25.54     10.78     4.57     0.48     0.27     0.13       21.41     9.04     3.83     0.40     0.23     0.12       18.28     7.72     3.27     0.35     0.20     0.11	70.0	31.20	13.17	5.58	0.58	0.32	0.16	90.0	
21.41     9.04     3.83     0.40     0.23     0.12       18.28     7.72     3.27     0.35     0.20     0.11	80.0	25.54	10.78	4.57	0.48	0.27	0.13	0.07	
18.28 7.72 3.27 0.35 0.20 0.11	0.06	21.41	9.04	3.83	0.40	0.23	0.12	0.07	
	100.0	18.28	7.72	3.27	0.35	0.20	0.11	90.0	

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

TABLE B-9. CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH 2800 TO 3400 FEET)

Distance Downstream from Spill in Nautical			Rive	River Depth in Feet	ى		
Miles	5	10	20	30	20	100	200
0.1	286788.84	88171.30	34562.41	3579.39	1923.23	843.62	384.50
0.2	135444.77	40537.77	12879.51	1273.28	680.00	298.26	135.94
0.3	83429.44	26532.21	7860.63	718.01	370.75	162.35	74.00
9.0	57940.38	19370.88	5752.46	497.08	242.78	105.45	90.87
0.5	43227.34	14992.52	4559.63	383.51	176.94	75.46	34.39
9.0	33835.20	12059.95	3770.90	314.42	138.46	57.43	26.16
0.7	27411.45	9976.54	3202.44	267.34	113.85	45.63	20.76
0.8	22790.72	8432.09	2770.75	232.72	96.96	37.45	16.99
0.0	19336.26	7249.13	2431.25	205.91	69. 88	31.51	14.24
1.0	16674.01	6319.19	2157.42	184.40	75.37	27.07	12.16
2.0	6168.24	2461.87	925.14	84.91	36.38	11.06	4.32
3.0	3409.49	1385.95	540.81	51.41	23.24	7.14	2.44
0.4	2231.69	915.71	364.49	35.34	16.54	5.29	1.69
5.0	1604.31	662.02	266.76	26.19	12.55	4.18	1.30
0.9	1224.23	507.11	206.04	20.40	9.95	3.42	1.07
7.0	973.66	404.42	165.30	16.47	8.13	2.87	0.91
8.0	798.26	332.25	136.42	13.66	6.81	2.46	0.79
9.0	669.85	279.25	115.07	11.57	5.81	2.13	0.70
10.0	572.52	238.98	98.76	96.6	5.03	1.88	0.63
20.0	203.37	85.38	35.74	3.65	1.90	0.77	0.29
30.0	110.87	79.97	19.61	2.01	1.06	94.0	91.0
40.0	72.07	30.35	12.79	1.32	0.70	0.29	0.12
50.0	51.59	21.74	9.17	0.95	0.50	0.21	0.10
0.09	39.26	16.55	66.9	0.72	0.38	0.17	0.08
70.0	31.16	13.14	5.55	0.57	0.31	0.14	0.07
80.0	25.51	10.76	4.55	0.47	0.25	0.11	90.0
0.06	21.38	9.05	3.81	0.39	0.21	0.10	0.05
100.0	18.26	7.70	3.26	0.34	0.18	0.09	0.05

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

CONCENTRATION FACTOR FOR SOLUBLE CHEMICAL IN A FLOWING STREAM (WIDTH GREATER THAN 3400 FEET) TABLE B-10.

Distance Downstream from Spill in Nautical			Rive	River Depth in Feet	Ų.			
Miles	5	10	20	30	50	100	200	
0.1	286612.31	88040.59	34441.64	20861.90	1906.66	829.58	372.52	
0.2	135352.39	40487.98	12839.88	7422.02	674.14	293.30	131.71	
0.3	83368.13	26498.76	7839.79	4187.10	367.58	159.65	71.69	
0.4	57895.90	19345.16	5738.25	2900.09	240.77	103.70	46.57	
0.5	43193.22	14971.72	4548.53	2238.20	175.54	74.21	33.32	
9.0	33807.98	12042.64	3761.61	1835.31	137.42	26.48	25.35	
0.1	27389.09	9961.85	3194,38	1560.63	113.04	44.88	20.11	
8.0	22771.94	8419.41	2763.61	1358.57	96.30	36.83	16.46	
0.9	19320.19	7238.04	2424,84	1202.01	84.15	31.01	13.80	
1.0	16660.06	6309.39	2151.62	1076.43	74.90	26.65	11.78	
2.0	6162.92	2457.80	922, 34	495.40	36.15	10.92	4.19	
3.0	3406.52	1383.61	539.10	299.88	23.09	7.05	2.37	
4.0	2229.74	914.14	363.30	206.10	16.43	5.23	1.64	
5.0	1602.90	660.88	265.88	152.72	12.46	4.13	1.27	
0.9	1223.15	506.23	205.35	118.97	9.87	3.38	1.04	
7.0	972.80	403.72	164.75	96.05	8.07	2.83	0.89	
8.0	797.55	331.67	135.96	79.64	97.9	2.42	0.17	
9.0	669.26	278.76	114.68	67.43	5.17	2.11	0.68	
10.0	572.02	238.57	98.42	58.04	66.9	1.85	0.61	
20.0	203.19	85.23	35.62	21.30	1.89	0.75	0.28	
30.0	110.77	46.56	19.54	11.74	1.05	0.43	0.17	
40.0	72.01	30.29	12.74	7.67	0.69	0.29	0.12	
50.0	51.55	21.70	9.14	5.51	0.50	0.21	0.09	
0.09	39.23	16.52	96.9	4.20	0.38	0.16	0.0	
70.0	31.13	13.12	5,53	3.34	0.30	0.13	90.0	
80.0	25.49	10.74	4.53	2.74	0.25	0.11	0.05	
0.06	21.36	00.6	3.80	2.30	0.21	0.0	0.04	
100.0	18.24	7.69	3,25	1.96	o. 18	90.0	0.0	

Note: Concentration factors are given in units of mg/liter per ton of spilled chemical.

#### APPENDIX C

#### HAZARDOUS CHEMICAL DATA

Manual Two of the Chemical Hazard Response Information System (CHRIS), published in October 1978 by the U.S. Coast Guard, is a compendium of chemical and physical property data for 900 commonly shipped hazardous chemicals. For each of these substances, the manual lists the specific chemical, physical, and biological data needed for the preparation and use of the other components of the CHRIS system. The manual can also be used after the initial response action, when there is sufficient time to use more detailed information, and can serve as a reference for investigating classes of hazardous materials and action on discharge.

Much of the quantitative data contained in Manual Two is needed for the hazard assessment calculations described in the Hazard Assessment Handbook and Hazard Assessment Computer System (HACS) modules of CHRIS. For use with HACS, the appropriate chemical property data has been transcribed to a separate computer file which is automatically accessed during computations to obtain this data.

The Hazardous Chemical Data manual contains, for each chemical, the Hazard Assessment Code which directs the user of the Hazard Assessment Handbook or HACS to the appropriate calculation procedure. The Hazardous Chemical Data manual also suggests general responses to an accidental discharge which summarize the detailed information given in the Response Methods Handbook.

This Appendix contains excerpts from the Hazardous Chemical Data Manual of CHRIS, specifically, individual data sheets for 27 selected

substances. The data sheets are arranged in alphabetical order by compound name. The complete U.S. Coast Guard publication should be referenced for explanation of terms, use of conversion factors, compatibility guides, and additional indices.

## BENZENE

	Brazel Floats on water. Flammable, irritating vapor is produced. Freezing point is 42° F.  Avoid contact with liquid and vapor. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources and call fire department. Stop discharge floatable. Stay upward and ord floatable and the self-contained breathing apparatus. Notify local health and pollution control agencies.  FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with day chemical, foam, or carbon dioxide. More may be interfective or her Cool exposed containers with water.		Tammable, irritating vapor is produced. Freezing people away. pparatus.	Fleam Point: 12°F C C     Fleammable Limit in Air:         1 VF 7 9°,         6.3 Fire Extinguishing Agenta: Dry chemical, footh, or carbon drivide         6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective         6.5 Special Hazards of Combustion Products: Not pertinent         6.6 Behavior in Fire: Vapor is heaver than air and may travel considerable distance to a		8.1 Aquestic Toxicity: Sport of the manow tethal distilled water 20 ppm 24 fit switch 11 in 12p water  8.2 Waterfoot Toxicity: Data mit available 8.3 Biological Oxygen Demand (BOD): 1.2 lb. lb. 10 days  8.4 Food Chain Concentration Potential: Note:
			source of ignition and flash back 6.7 Ignition Temperature: (ION**) 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 6.0 mm min		9. SELECTED MANUFACTURERS  1. Commonwealth Ool Retining Co., Inc. Commonwealth Petrochemicals Co. Penuclas Puerto Rico (0) '24  2. Phillips Petroleum Co. Phillips Puerto Rico Core, Inc.	
	Exposure	Move to fresh air. If breathing has stopped, giv If breathing is difficult, give LIQUID Initiating to skin and eyes. Hammful if swallowed. Remove contaminated cloth Flush affected areas with pi	throat, the difficult breathing, or loss of consciousnem. The artificial respiration. The artificial respiration on the second of the second o	7.2 7.3 7.4	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acide and Caustics: Not pertinent Polymerization: Not per	Banco Popular Center Hatro Res. P. R. 1993/6 3. Shelf Chemical Co. Petrochemicals Dis. P. O. Bin. 2463. Houston, Texas 77(8)1
		IF IN EYES, hold eyelids of IP SWALLOWED and victir or milk.	pen and flush with plenty of water, m a CONSCIOUS, have victim drink water		Inhibitor of Polymerization: Not perturent	10. SHIPPING INFORMATION  10.1 Grades or Purity.  Industrial pure 99+1  Thisphene-free 99+1  Nitration 99+1
	Water Pollution	HARMFUL TO AQUATIC May be dangerous if it enter Notify local health and wild Notify operators of nearby	llife officials.			Industrial WIV K5+17 Respect 10.2 Storage Temperature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Venting: Pressure vacuum
		TO DISCHARGE de Hendbook, CQ 446.4) ligh (Lammahility	2. LABEL		11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook CG 446-3) A-T-(1)-V-W	13. PHYSICAL AND CHEMICAL PROPERTIES   13.1   Physical State at 15°C and 1 atm: 1 iquid   13.2   Molecular Weight: 78 ii   13.3   Boiling Point at 1 atm: (78°1 = 80 10°C = 353 3°K)   13.4   Freezing Point:
32	Synonyme: Benzo Benzo Coast Guard Corr Arom Chemical Formula	le opetibility Classification: atic hydrocarbon s: C.H. ione Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): I i quid 4.2 Color: Culorless 4.3 Odor: Aromatic, rather pleasant aromatic odor, characteristic odor		12. MAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable legal NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire Health Vapor Irritant Liquid or Yolid Irritant Parsons	42 0° F = 2 5° C = 278.7° K
	5. HEALTH HAZARDS  Personal Protective Equipment: Histocarbon vapor cansier, supplied are or a bose mask. Instruction insoluble under or plastic gloses, chemical griggles or face splash shield, histocarbon insoluble approximate as reoperne.			Witer Pollution Human Toxici's I Aquatic Toxici's 1 Aesthetic Effect 2 Reactivits Other Chemicals I Water 0	13 11 Ratio of Specific Heats of Vapor (Gae): 1 (bit 13 12 Letent Heat of Vaporization: 1 (bit Bits the 94 Leaf g = 3.94 × 10° J kg 13 13 Heat of Combustion: - 17 4ntl Bits th = -969kcal g = -406.0 × 16° J kg	
53 1	Symptome Pollowing Enpodure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest construction. Coma and possible death.  Treatment for Enpodure: SNTS. flush with water followed by soap and water, remove contaminated solithing and wash skin. FYES. flush with plents of water until irritation subsides. ISMALATION—more from exposure immediately. Call a physician. If breathing is regular or stopped, start resuscitation, administer oxygen.  Toatelyty by inhabition (Threathoff Limit Value): 25 ppm.		12.3	Self-Reaction 0  MFPA Hazard Closeifications:  Category Closeification  Health Hazard Blue Flammability (Red) 3  Reactivity (Yellow) 0	13.14 Heat of Bountposition: Not pertinent 13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymortzation: Not pertinent	
		Noc: Limita: 75 ppm for 30 m		, j		*Continued on pages 5 and 6
	<b>Toxicity by Ingostic</b> L <b>ate Texicity</b> : 1 cul	MC Grade 3, ED <sub>M</sub> 50 to 500 n temia	ng /kg	1		
	Voper (Gas) irritan	Characteristics: If presen	it in high concentrations, sapors may cause irritation of	1 I	NO	TES
5 9 1		rs system. The effect is tempo <b>ant Characteristics</b> : Minin	wars num hazard. If spilled on clothing and allowed to remain,	li		
	may cause smarting and reddening of the skin					

#### **CRESOLS**

Common Synony Crenylic acade Hydroxy solomana Marthy lybourols Oxytolumana	Watery Equid, or solid cr Sinks in water.	ystalb Coloriess or Sweet tarry odor yellow			
	ct with liquid. Keep people away , self-contained breathing apparatus, ing gloves) ge if possible artment, wmove discharged material, health and pollution control agencies				
Fire	Combustible: POISONOUS GASES MAY BE PRODUCED IN FIRE.  West poggles and self-contained breathing apparatus.  Extinguish with water. dry chemical, foam or carbon dioxide.  Cool exposed containers with water.				
Exposure	CALL FOR MEDICAL AID. LIQUID Will burn skin and eyes. Hammid if swallowed. Remove contaminated cluthing an Frush affected areas with plenty or IF SWALLOWED and victim is CC multi- multi- DO NOT INDUCE VOMITING.	d shores I water of Bush with plenty of water ONSCIOUS, have victim drink water or			
Water Pollution	HARMFUL TO AQUATIC LIFE IF May be dangerous if it enters water Notify local health and wildlife of Notify operators of nearby water	Ticials.	•		
(Sae Pérspan Essue Warr poison Restrict a Should be Chemical		2. LABEL POISON  4. OBSERVABLE CHARACTERISTICS			
3 1 Synonyme: 3 2 Coast Quar 3 3 Chemical F 3 4 HMCO/Unit	Cressite acids Hydroxytoluenes Methylphenols Dyxtoluenes Far acids d Compatibility Classification: Cresol cermida: CHA_HAOH ad National Numerical	4.1 Physical State (as shipped): Lugud or solid 4.2 Color: Colorless to dark sellow 4.3 Odor: Sweet, tarry			
5 1 Personal Pi 1 S By rubber at 5 2 Symptome skin or c 5 3 Treatment i have vet immedia immedia immedia 5 4 Toxiolity by 5 5 Short-Toxiol 5 7 Toxiolity by 5 7 Late Toxiol 5 8 Vapor (Geo find high 5 9 Liquid or 8 degree b	5. HEALTH HAZARDS  5. HEALTH HAZARDS  5. Personnal Protective Equipment: Organic vapor canneter unit (USBM Type B) approved by 1. So Bureau of Mines. Rubber gloves, chemical safets goggles, face shield; coveralls and/or rubber apron, rubber shoes or boots.  5.2 Symptome Pollowing Exposure: Vapors cause tritation of eves, nose, and throat. Contact with skin or eves causes evere burns. Chemical is rapidly absorbed through skin.  5.3 Treatment for Exposure: Call a physician. INHALATION remove to fresh air. INGESTION have victim drink water or milk, do NOT induce vomiting. SKIN OR EVES, Bush immediately with plenty of water for at least 15 min., remove contaminanted clothing immediately with plenty of water for at least 15 min., remove contaminanted clothing immediately and wash before reuse, discard contaminated shoes.  5.4 Totacity by Inholoiton (Threathold Limit Value): S. Spim.  5.5 Short-Term Inholoiton Limite: Data not available.  5.6 Totacity by Ingestion: Grade 2.1.D=0.5 to 5.g/kg (rat, rabbit).  5.7 Lote Texticity: Data not available.  5.8 Vapor (Gog) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.				
I					

Γ	6. FIRE HAZARDS
6.1	Flash Point: 175-185° FOC.
6.2	Florenable Limits in Air: LEL 1.4% (ortho), 1.1% (
6.3	Fire Extinguishing Agents:
6.4	dry chemical, carbon dioxid Fire Extinguishing Agents N
6.5	Special Hazards of Combus
	Flanimable toxic vapors giv
6.6	Behavior in Fire: Sealed closs can huild up pressure if exp
6.7	(tire)
١.,	1038; Firm-or p-cresol)
6.8 6.9	Electrical Hazard: Data not a Surning Rate: Data not avail
	7. CHEMICAL REACTIV
7.1	Reactivity with Water: No re
72	Reactivity with Common Ma
73	Stability During Transport:
7.4	Neutralizing Agents for Acid Caustics: Not pertinent
7.5	Polymerization: Not pertine
76	Inhibitor of Polymerization: Not pertinent
ŀ	
ŀ	
	11. HAZARD ASSESSMENT
	(See Hazard Assessment Handbook
	A-P-Q-T-U-X-Y
_	12. HAZARD CLASSIFICAT
12.1	Code of Federal Regulation: Poisonous liquid or solid, CI
	who is inquite of solid, Cl

#### int: 175-185°FOC. justic Toxicity: 24 mg/1796 hr/bjucgill/TI my fresh water olo Limita in Air: 1.4% (ortho), 1.1% (meta or para) 10 (00 ppm 48 fg. shrimp. I Ca. salt water Waterloud Toxicity: Data not available ngulahing Agenta: Water. hemical, carbon dioxide, and foam 8.3 Biological Oxygen Demend (BOD): m-cresol 170%, 5 days p-cresol 164%, 5 days nguishing Agents Not to be Used: ertinent **B 4** Food Chain Concentration Pote nable toxic vapors given off in Fire: Sealed closed containers old up pressure if exposed to heat 9. SELECTED MANUFACTURERS Allied Chemical Corp Plastics Division Morristown, N. J. 07960 Temperature: 1110°F (o-cresol) F (m-or p-cresol) al Hazard: Data not available Continental Oil Co Pitt-Consol Chemicals Division Park 80 Plaza Fast Saddle Brook, N. J. 07662 Rate: Data not available CHEMICAL REACTIVITY Koppers Co., Inc. Organic Materials Division ity with Water: No reaction Pittsburgh, Pa. 15219 ity with Common Materials: Ouring Transport: Stable izing Agents for Acide and St. Not pertinent rization: Nul pertinent of Polymerization: 10. SHIPPING INFORMATION 10.1 Gradeo or Purity: USP Liquid (mixed isomers) Phenol-cresol mixtures Ortho-cresol 80 to 98% containing phenol Meta-cresol 60 to 98% containing other cresols and aylenols Para-cresol 92 to 98% containing metacresol Meta-para-cresol containing orthocresul and astenuts ZARD ASSESSMENT CODE 13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: 1 iquid A - P-O - T - U - X - Y 13.2 Molecular Weight: 10K 13 13.3 Boiling Point at 1 atm: >350°F =>177°C =>450°K 13.4 Freezing Point: Not pertinent AZARD CLASSIFICATIONS 13.5 Critical Temperature: Not pertinent 12.1 Code of Federal Regulations: Poisonous liquid or solid, Class B 12.2 NAS Hazard Rating for Bulk Water 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 1.03 | 1.07 at 20°C (figurd) 13.8 Liquid Surface Tension: 37 dynes cm = 0.037 N m at 20°C Category 13.9 Liquid-Water Interfecial Tension: Fire Data not available 13 10 Vapor (Gas) Specific Gravity: Not pertinent Vapor Irritant Liquid or Solid Irritant Poisons 13.11 Ratio of Specific Heats of Vapor (Gas): 1 073 Water Pollution 13.12 Latent Heat of Vaporization: (est ) 200 Bto/th≠ 110 cal. g = 4.6 × 10° J, kg Human Toxicity Aquatic Toxicity Aesthetic Effect 13.13 Heat of Combustion: -14,720 to -14,740 Btu-Ib Reactivity Other Chemicals = -8180 to -8190 calls = -342 5 to -342 9 × 10° J/kg Water Self-Reaction eition: Not pertinent 13.14 Heat of Decem 12.3 NFPA Hazard Cle 13.15 Heat of Solution: Not pertinent Category 13.16 Heat of Polymerization: Not perment

8. WATER POLLUTION

10. SHIPPING INFORMATION (Cont'd.)

meta and ortho para

"Resin" cresols containing phenols and sylenols Cresylic acids containing sylenols.

cresols and phenols 10.2 Storage Temperature: Ambient

Health Hazard (Blue) Flammability (Red)

Reactivity (Yellow)

10.3 Inert Atmosph PC No requirement

10.4 Ventings Open

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I Continued on pages 5 and 6

### **DICHLOROMETHANE**

Avoid cont Isolate and	Watery liquid Colorless Sweet, pleasant odor  Sinks in water Irritating vapor is produced.  get possible twith liquid and sapor move discharged material mendith and pollution control agencies.		62 63 64 65	6. FIRE HAZARDS  Flash Point: Not flammable under conditions likely to be encountered.  Flammable Limits in Air: 12 - 19 - 17 - 17 - 17 - 17 - 17 - 17 - 17	8. WATER POLLUTION 8.1 Aquatic Toxicity:     Not perturent 8.2 Waterfowl Toxicity: Not perturent 8.3 Biological Oxygen Demand (BOD):     Not perturent 8.4 Food Chain Concentration Potential:     None	
Fire	Not flammable. POISONOUS GASES ARE PI Wear goggles and self-contain Cool exposed containers with	ned breathing apparatus	6 7 6 8	Behavior in Fire: Not pertinent  Ignition Temperature: 1184    Electrical Hazard: Not pertinent  Burning Rate: Not pertinent	9. SELECTED MANUFACTURERS  1. Amon Chemical Corp Westlake: La "Moo"  2. Dios Chemical Cor Midland, Mich. 48640  3. Ethal Corp	
Exposure	If inhaled, will cause nausea a Move to fresh air If breathing has stopped, give if breathing is difficult, give LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated cloth	IPOR tating to eyes, nose and throat habed, will cause nauses and duziness. breathing has stopped, give artificial respiration breathing has followed over the stopped of the stopped of the stopped over the stop		7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not perturent Polymerization: Not per	Industrial Chemicals Dission AST Florida St. Baton Rouge, La. "0001	
Water Pollution	IF IN EYES, note eyelds up IF SWALLOWED and victim or milk.  Effect of low concentrations. May be dangerous if it enters. Notify local health and pollu Notify operators of nearby w	water intakes. Ition control officials.		Inhibitor of Polymerization:  3 petiment	10. SHIPPING INFORMATION  10.1 Grades or Purity: Acrossi grade technical grade  10.2 Storage Temporatures: Data merascribile  10.3 Inert Atmosphere: Inerted  10.4 Venting: Data not available	
	E TO DISCHARGE hods Mandbook CG 446-4)	LABELS     No hazard label required by     Code of Federal Regulations		11. HAZARD ASSESSMENT CODE (Sine Hazard Assessment Handbook CG 446 to A-P-X	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: 1 squid 13.2 Molecular Weight: \$4.9% 13.3 Boiling Point at 1 atm:	
3.1 Synonyms: Met Met 3.2 Coast Guard Co	stions Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (se shipped): Unjoid 4.2 Colories 4.3 Odor: Pleasant, aromatic, like chloroform, sweet, ethereal	1 1	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM: A NAS Hezerd Rating for Bulk Water Transportation: Category Rating Line     Health     Vapor Irritant   2 Liquid or Solid Irritant   1 Persons     Water Pollution	104 } ± W × C = X 3 n	
clothing  5.2 Symptoms Follo CONTACT W  5.3 Treatment for E: INGESTION clothing, wish	5. HEALTH HAZARDS  Personal Protective Equipment: Organic vapor canister mask, salety glasses, protective clothing  Symptoms Following Exposure: INHALATHON: anewhetic effects, nausea and drunkenness  CONTACT WITH SAIN AND LYTE skin orrelation, irritation of eyes and nose  Treatment for Exposure: INHALATHON: remove from exposure: Give oxygen it needed  INGINION in specific antidate CONTACT WITH SAIN AND LYTES remove contaminal childring, such skin or exest a directed.  Totalety by inhalation (Treached) of Limit Value): 500 ppm.		12.3	Human Toxicity	13 11 Ratio of Specific Heats of Vapor (Gas):  (199  13 12 Latent Heat of Vaporization:  (42 Bits 15 × 75 °c,d g = 3.30 × 10° 1 ky  13 13 Heat of Combustion: Not pertinent  13 15 Heat of Decomposition: Not pertinent  13 16 Heat of Solution: Not pertinent  13 16 Heat of Polymerization: Not pertinent	
55 Short-Term Inha 56 Texicity by Inger 57 Late Texicity: \( \) 58 Vapor (Gas) Irrit	ntation Limits: 100 ppm for 6 stion: Grade 2, I D <sub>m</sub> O 5 to 5 g. sone tant Characteristics: Vapors	O min. /kg cause moderate cretation such that personnel will		Nammahitis (Red) 1 Reactivity (Yellow) 0	(Construed in pages 5 and 6)	
5.9 Liquid or Solid in remain, may c	find high concentrations unpleasant. The effect is temporary.  Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.  Odor Threuhold: 205-307 ppm.			N	OTES	

# 1,1-DIMETHYLHYDRAZINE

	Common Synony UDMH Dimerine		Watery liquid	Coloriem	Fishy or ammonis-like odor	
	annym-Dimethy Bydr	utime .	Floats and mixes wi	ith water.		
	AVOID CONTACT WI Wear chemical protects Shut off ignition source Stop discharge if possib Stay upwind and use w Evacuate area in case o		es and call fire departs ble: rater spray to "knock of if large discharge	nent. down" vapor.	: away. neratus.	
	Notify local		thorged material. I pollution control age			
	Fire	Vapor n Wear ch Flood d	FLAMMABLE  FOISONOUS GASES ARE PRODUCED WHEN HEATED. Flashback along vapor trail may occur. Vapor may expode if ignated in an enclosed area. Wear chemical protective suit with self-contained breathing apparatus. Flood discharge area with water. Extinguish with water.  CALL FOR MEDICAL AID.  VAPOR  FOISONOUS IF INHALED OR IF SKIN IS EXPOSED. Irritating to eyes. More to fresh air. If breathing is difficult, give artificial respiration. If breathing is difficult, give oxygen.  LAQUID  FOISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. Will burn eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF SY EXPOSED with plant of the plan			
	•	VAPOR POISON Irritatin Move to If breat				
	Exposure	LIQUID POISON Will burn Remove Flush at IF IN E IF SWA				
	Water Pollution	Effect o May be Notify	of low concentrations of dangerous if it enters local health and wildli operators of nearby wi	on aquatic life is u water intakes. Ife officials.	nknown.	
	1. RESPONSE TO DISCHARGE (500 Response Methods Handbook CG 446-4) Issue warning—high flammubility Restrict access I sacvate area Disperse and thish		lok CG 446-4)	4	2. LABELS POISON	
	3. CHEMICAL		VATIONS		ERVABLE CHARACTERISTICS	
3.1	Synonyma: Dana L.DN unsse	мн	nythydrazine	4.2 Color: (		
3.2	Coast Guard Cor		ty Classification:	4.3 Odor: 5	sharp anonomacal, tishy	
3.3	Chemical Formulation (Internation)	itions Hu				
	with ammonia or higher conce	(GMD) contrations.	anister protects for 30 , use self-contained br	es, boots, and apro From against Co reathing apparatu		
5 2	intestinal irrita chemical hurns	ition, frem Can be a	iors, and convulsions absorbed through skin	Contact with skir Hircause systems	othnonary irritation, delayed gastro- n or muçous thembranes causes c intoxication and consulsions	
53	respiration and INGLNITON treat as alkabit	Lorsgen il do NOT : ic hurn	I needed, watch for sig- induce somiting, hosp	ens of pulmonars piralize SKIN Of	contaminated area give artificial edema, enforce absolute rest. R 1 Y ES. Bood with water and	
5.4			reshold Limit Value mits: 100 nom for 10		Wenne Wepper for Minne	
56			ade 3. ID-681155081		* *	
5 7	Late Toxicity: 1): Mild anemia, up	ala not as. pper respii	artable ratory irritation, and	I muscle tremors	in dogs following chronic exposure.	
58	usqally (olerati	(spor (Goe) britant Cheracteristics: Vapor is moderately irritating such that personnel will not usually (olerate moderate or high concentrations).				
5.9					auses second, and third degree	

	6. FIRE HAZARDS		8. WATER POLLUTION
1	Flash Point: 34°E C C		8.1 Aquatic Texicity: Data not available
2	Flammable Limits in Air: 2%	95%	8.2 Waterlouf Toxicity: Data not available
3	FC:a Extinguishing Agents: Flo		8.3 Biological Oxygen Demand (BOD):
	water		Data not available
4	Fire Extinguishing Agents Not		8 4 Food Chain Concentration Potential:
	In large fire - water log, carbo and bicarbonate types may all		Data not available
	back and explosive resignation		
5	Special Hazards of Combustio	n Products:	
	None		1
6	Behavior in Fire: Tends to re-ig	nite unless	
7	diluted with much water		
, A	Ignition Temperature: 452 49		9. SELECTED MANUFACTURERS
9	Electrical Hezerd: Class F. Gro Burning Rate: 3 X mm - min	up D	FMC Corporation
,	Durning Peace: 1 k mm / mm		Organic Chemicals Division 633 Third Ave
			New York, N. Y. 10012
			ļ
	7 64544444		]
_	7. CHEMICAL REACTIVIT		
1	Reactivity with Water: No reac		
2	Reactivity with Common Mater		1
	Dissolves, swells, and disinteg many plastics	rates	
3	Stability During Transport: St.	chia belam	
3	1112°F	Inic ociów	
4	Neutralizing Agents for Acids :	end	
	Caustics: Flush with water		
5	Polymerization: Not pertinent		10. SHIPPING INFORMATION
6	Inhibitor of Polymerization: N	of perfinent	10.1 Grades or Purity: Propellant-grade 98% min
			10.2 Storage Temperature: Below 120°E
			10.3 Inert Atmosphere: Inerted
			10.4 Volting: Data not available
			13. PHYSICAL AND CHEMICAL PROPERTIES
	11. HAZARD ASSESSMENT C		
			1
	(See Hazard Assessment Handbook CG		13 1 Physical State at 15°C and 1 atm: Liquid
	(See Hazard Assessment Handbook, CG A : P · Q · R · S		13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 40 11
			13 1 Physical State at 15°C and 1 atm: Liquid
			13.1 Physical State at 15°C and 1 atm: [ iquid 13.2 Molecular Weight: 40 II 13.3 Boiling Point at 1 atm:
	A-P-Q-R-S  12. HAZARD CLASSIFICATIO	.446 31	13   Physical State at 15°C and 1 atm:   iquid   13   Molecular Weight: 60   1   13   Bolling Point at 1 atm:      40   0°   = 63.3°C = 336.5°K
,	A-P-Q-R-S  12. HAZARD CLASSIFICATION Code of Federal Regulations:	.446 31	13.1   Physical State at 15°C and 1 atm:   iquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:
	A-P-Q-R-S  12. MAZARD CLASSIFICATIO Code of Federal Regulations: Flammable Inquid	.446 31 PNS	13.1 Physical State at 15°C and 1 atm: [ liquid   13.2 Molecular Weight: κο 10   13.3 Boiling Point at 1 atm:   14κ ν   1 = κ   15 κ   1 = κ
1 2	A-P-Q-R-S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Hammable highd NAS Hazard Rating for Bulk W	.446 31 PNS	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:
	A-P-Q-R-S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid HAS Hazard Rating for Gulk W Transportation:	.446 31 NNS	13.1   Physical State at 15°C and 1 atm:   iquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:
	A-P-Q-R-S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Hammable highd NAS Hazard Rating for Bulk W	.446 31 PNS	13.1   Physical State at 15°C and 1 atm:   liquid   13.2
	A-P-Q-R-S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid HAS Hazard Rating for Gulk W Transportation: Category Line	NS later Rating	13.1   Physical State at 15°C and 1 atm:   iquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:   Iden 0°f = 61.3°C = 316.5°K   13.5   Critical Temperature:   Air 1 = 240°C = 52°K   13.6   Critical Pressure:   Air 1 = 240°C = 52°K   13.6   Critical Pressure:   M65 paid = 51.5 atm = 5.40 M N / m'   13.7   Specific Gravity: 0.791 at 20°C (Inquid)   13.8   Liquid Surface Temsion:   28 dans c.m. = 0.028 N, m. at 25°C   13.9   Liquid-Water Interfacial Temsion:
	A.P.Q.R.S  12. NAZARD CLASSIFICATIO Code of Federal Regulations: I lammable liquid NAS Hazard Reting for Bulk W Transportation: Category	NS later Rating	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   Bolling Point at 1 atm:
	A-P-Q-R-S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk W Transportation: Category Line Health Vapor Instant Equal or Solid Front in	NS Vator Rating	13.1   Physical State at 15°C and 1 atm:   iquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:   Iden 0°f = 61.3°C = 316.5°K   13.5   Critical Temperature:   Air 1 = 240°C = 52°K   13.6   Critical Pressure:   Air 1 = 240°C = 52°K   13.6   Critical Pressure:   M65 paid = 51.5 atm = 5.40 M N / m'   13.7   Specific Gravity: 0.791 at 20°C (Inquid)   13.8   Liquid Surface Temsion:   28 dans c.m. = 0.028 N, m. at 25°C   13.9   Liquid-Water Interfacial Temsion:
	A.P.Q.R.S  12. MAZARD CLASSIFICATIO Code of Federal Regulations: Hammable highd NAS Hazard Rating for Bulk W Transportation: Category Fine Health Vapor firstant Equid or Solid from at Powers	MS  /ater  Rating	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:   liquid   14.0°F = 61.3°C = 316.5°K   13.5   Critical Temperature:   Air   1 = 240°C = 52°K   13.6   Critical Pressure:   Air   1 = 240°C = 52°K   13.6   Critical Pressure:   A65 paid = 51.5 atm = 5.40 MN/m*   13.7   Specific Gravity: 0.791 at 20°C (liquid)   13.8   Liquid Surface Tension:   28 dans c.m = 0.028 N. m. at 25°C   13.9   Liquid-Water Interfacial Tension:   Not pertinent   13.10   Vapor (Gas) Specific Gravity: 2   13.11   Ratio of Specific Heats of Vapor (Gas):
	A-P-Q-R-S  12. MAZARD CLASSIFICATIC Code of Federal Regulations: Flammable fiqued MAS Hazard Rating for Bulk W Transportation: Category Lite Pleatith Vapor firstant Equation Solid Iron of Porcans Water Pollution	NS NS Rating	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:
	A-P-Q-R-S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid NAS Hazard Reting for Bulk W Transportation: Category Line Health Vapor Instant Equal or Solid Iros int Poisons Water Pollution Haman Lowers	NS Vator Rating	13.1   Physical State at 15°C and 1 atm:   I quid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:
	A-P-Q-R-S  12. MAZARD CLASSIFICATIC Code of Federal Regulations: Flammable fiqued MAS Hazard Rating for Bulk W Transportation: Category Lite Pleatith Vapor firstant Equation Solid Iron of Porcans Water Pollution	NS NS Rating	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Bolling Point at 1 atm:   liquid   14.00°   = 0.13°C = 3.05°K   13.5   Critical Preseure:   Air 1 = 2.40°C = 2.26°K   13.5   Critical Preseure:   Air 1 = 2.40°C = 2.27°K   13.6   Critical Preseure:   Air 2 = 2.27°K   13.7   Specific Gravity: 0.79°( at 2.0°C (thquid)   13.8   Liquid Surface Tension:   26 doines on = 0.028°N, mart 2.5°C   13.10   Liquid Water Interacial Tension:   Not pertinent   13.10   Vapor (Gae) Specific Gravity: 2   13.11   Reito of Specific Heats of Vapor (Gae):   (et )   1.15°C   13.12   Letent Heat of Vaporization:   20.18°C   14.18°C   14.18°
	A-P-Q-R-S  12. MAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid MAS Hazard Rating for Bulk W Transportation: Getegory Fire Health Vapor Irritant Equid or Solid Irrit int Possins Water Pollution Human Lossetts Vaguats Lossetts Vaguats Lossetts	rater Rating	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:   lide 0°   = 6.13°C = 336.5°L   13.4   Freezing Point: -7.11°L = -5.7°C = 216°L   13.5   Critical Temperature:   An '1   = 7.49°C = 5.2°L   13.6   Critical Temperature:   An '1   = 7.49°C = 5.2°L   13.6   Critical Pressure:   M6   poid = 5.40 M N / m   13.7   Specific Gravity: 0.79°L at 25°C (figuid)   13.8   Liquid Surface Tension:   26.45 nes un = 0.02 N / m at 25°C   13.9   Liquid-Water Interfacial Tension:   Not pertined   13.10   Vapor (Gas) Specific Gravity: 2.1   13.11   Retio of Specific Heats of Vapor (Gas):   (es.)   1.152   13.12   Latent Heat of Vapor (zailon: 26.18 to 16.13   13.13   Heat of Combustion: -14.170 Bit. 18 to 16.13   13.14   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   Heat of Combustion: -14.170 Bit. 18 to 16.15   13.15   1
	A-P-Q-R-S  12. MAZARD CLASSIFICATIC Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk W Transportation: Category Fire Fleatith Vapor firstant Equid or Solid Iron of Poisons Water Pollution Human Towerts Vegata Coverts Vesthets Effect Reactions Other Chemicals	rater Rating 4 4 4 2 2 4	13.1   Physical State at 15°C and 1 atm:   I iquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:
	A.P.Q.R.S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid HAS Hazard Reting for Bulk W Transportation: Category Line Health Vapor frotant Equal or Solid Frot int Possins Water Pollution Human Lowers Aquatic Lowerts Vechetic Fleet Reactions Other Chemicals Water	/446 3)  // Attended	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:   liquid   14.0°F = 61.3°C = 316.5°K   13.5   Critical Personaure:   Air 1 = 240°C = 52°K   13.5   Critical Personaure:   Air 1 = 240°C = 52°K   13.6   Critical Personaure:   Air 2 = 32°C   Air 3 = 32°C   Chiquid   13.8   Liquid Surface Tension:   28 days - sim = 0.028 N, m at 2.5°C   13.9   Liquid-Water Interfacial Tension:   Not pertinent   13.10   Vapor (Gas) Specific Gravity: 2   13.11   Ratio of Specific Heats of Vapor (Gas):   (eq. ) 1.15°C   13.12   Latent Heat of Vaporization:   26   Biu   b = 145°Cal y = 8.00 × 10°J Ng   13.13   Heat of Combustion:   -14.170 Biu   b = 147°Cal y = -129°J × 10°J Ng   12°4   Heat of Decomposition:   Not pertinent   13°C   14°C
.2	A.P.Q.R.S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid HAS Hazard Rating for Bulk W Transportation: Category Fire Health Vapor firstant Equid or Solid Froi int Poissons Water Pollution Human Fossets Aquatic Fossets Acquatic Fossets Cother Chemicals Water Self Reaction	## A 4 4 4 2 2 4 4 6 6 6 6 6 6 6 6 6 6 6 6 6	13.1   Physical State at 15°C and 1 atm:   I iquid     13.2   Molecular Weight: 60.11     13.3   Boiling Point at 1 atm:
	A.P.Q.R.S  12. MAZARD CLASSIFICATIC Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk W Transportation: Cotegory Fire Health Vapor firstant Equal or Solid Iron of Poisons Water Pollution Haman Towers Venter Effect Reactions Other Chemicals Water Sett Reaction NPPA Hazard Classifications	## A 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	13.1   Physical State at 15°C and 1 atm:   liquid   13.2   Molecular Weight: 60.11   13.3   Boiling Point at 1 atm:   liquid   14.0°F = 61.3°C = 316.5°K   13.5   Critical Personaure:   Air 1 = 240°C = 52°K   13.5   Critical Personaure:   Air 1 = 240°C = 52°K   13.6   Critical Personaure:   Air 2 = 32°C   Air 3 = 32°C   Chiquid   13.8   Liquid Surface Tension:   28 days - sim = 0.028 N, m at 2.5°C   13.9   Liquid-Water Interfacial Tension:   Not pertinent   13.10   Vapor (Gas) Specific Gravity: 2   13.11   Ratio of Specific Heats of Vapor (Gas):   (eq. ) 1.15°C   13.12   Latent Heat of Vaporization:   26   Biu   b = 145°Cal y = 8.00 × 10°J Ng   13.13   Heat of Combustion:   -14.170 Biu   b = 147°Cal y = -129°J × 10°J Ng   12°4   Heat of Decomposition:   Not pertinent   13°C   14°C
.2	A.P.Q.R.S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid MAS Hazard Rating for Bulk W Transportation: Category Fire Flexith Vapor firstant Enquid or Solid Front of Possons Water Pollution Human Lowerts Acquist Low	Rating 4 4 4 2 2 4 0 4 Isselfication	13.1   Physical State at 15°C and 1 atm:   liquid     13.2   Molecular Weight: 60.11     13.3   Bolling Point at 1 atm:
.2	12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk W Transportation: Category Fine Health Vapor frotant Equidor Solid Frot int Process Water Pollution Human Lowerts Aquatic Lowerts Aquatic Lowerts Aquatic Lowerts Aquatic Lowerts Other Chemicals Water Self Reaction NFPA Hazard Classifications: Category Fleath Flazard (Blue)	## A 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	13.1   Physical State at 15°C and 1 atm:   liquid     13.2   Molecular Weight: 60.11     13.3   Bolling Point at 1 atm:
.2	A.P.Q.R.S  12. HAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid MAS Hazard Rating for Bulk W Transportation: Category Fire Flexith Vapor firstant Enquid or Solid Front of Possons Water Pollution Human Lowerts Acquist Low	A46 31  NS  Fating 4 4 2 2 4 6 4 1 Cassification 3	13.1   Physical State at 15°C and 1 atm:   liquid     13.2   Molecular Weight: 60.11     13.3   Bolling Point at 1 atm:
.2	12. MAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk W Transportation: Category Fire Health Vapor firstant Equid or Solid Iron of Poissons Water Pollution Haman Lowerts Verified Lowerts Verified Coverts Verified Cove	A46 31 Wiss  Flating 4 4 4 2 2 4 0 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13.1   Physical State at 15°C and 1 atm:   liquid     13.2   Molecular Weight: 60.11     13.3   Boiling Point at 1 atm:
.2	12. MAZARD CLASSIFICATIO Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk W Transportation: Category Fire Health Vapor firstant Equid or Solid Iron of Poissons Water Pollution Haman Lowerts Verified Lowerts Verified Coverts Verified Cove	A46 31 Wiss  Flating 4 4 4 2 2 4 0 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13.1   Physical State at 15°C and 1 atm:   Inquid     13.2   Molecular Weight: 60.11     13.3   Bolling Point at 1 atm:

MOTES

## ETHYL ACETATE

Common Synony Acetic acid, ethyl este		
Acetic ester Vineger naphtha	r Watery liquid	Colorless Pleasant fruity odor annuable, irritating vapor is produced.
Stay upwind Avoid contac	e if possible. Keep people away, tion sources and call fire departs and use water spray to "knock of t with liquid and vapor- move discharged material, tealth and pollution control ager	lown" vapor.
FLAMMABLE. Flashback along vapor trail ma Vapor may explode if spirited Extinguish with dry chemical. Water may be ineffective on fi Cool exposed containers with		alcohol foam, or carbon dioxide. ire.
Exposure	IF SWALLOWED and victim i or milk.	dizziness, nausea, or artificial respiration.  xygen.  Ig and shoes.  Ity of water.  Is and flush with plenty of water.  Is CONSCIOUS, have victim drink water
Water Pollution	Effect of low concentrations of May be dangerous if it enters to Notify local health and wildlif Notify operators of nearby was	water intakes. le officials.
1. RESPONSE TO DISCHARGE  1500 Response Methods (1046-4)  Issue warning. high (lammability  Fish water area.  Disperse and flush		2. LABEL
Issue warning Evacuate area	e high flammability 1	
1-sue warning Fraudic are. Disperse and 3.1 Symonyme: Ac Ac Ac St. 3.2 Coost Guard C Is. 3.3 Chemical Forn.	En high flammability in the high flammability in the high flammability in the high flammability flammability flammability Classification: termolar: C.H.C.OOC.H.C.H	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Liquid 4.2 Celor: Colorless 4.3 Odor: Pleasant, truits

	<del> </del>
6. FIRE HAZARDS	8. WATER POLLUTION
6.1 Flash Point: 24°F C.C., SS°F O.C.	8 1 Aquatic Texicity:
6.2 Flammable Limits in Air:	Data not available  8.2 Waterlowi Toxicity: Data not available
6.3 Fire Extinguishing Agents: Alcohol foam,	8.2 Waterlowi Texicity: Data not available 8.3 Biological Oxygen Demand (BOD):
carbon dioxide or dry chemicals	(Theor ) 66%, 5 days
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent	8.4 Food Chain Concentration Potential:
6.5 Special Hazards of Combustion Products:	,
Not pertinent	
6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: RIKIP1	
68 Electrical Hazard: Class I, group D	
6.9 Burning Rate: 3. com mus	9. SELECTED MANUFACTURERS
	1 Eastman Kodak Co
	Tennessee Fastman Co., Div Kingspurt, Tenn. 37662
	2 Monsanto Co
	Monsanto Industrial Chemicals Cir 800 North Lindbergh Blvd
	St. Louis, Mo. 63166
7. CHEMICAL REACTIVITY	3 Union Carbide Corp Chemicals and Plastics Div
7 1 Reactivity with Water: Nurrelation 7 2 Reactivity with Common Materials:	270 Park Ave
No reaction	New York, N. Y. 10017
7.3 Stability During Transport: Stable	
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent	
7.5 Polymerization: Not pertinent	
7 6 Inhibitor of Polymerization:	10. SHIPPING INFORMATION
Not pertinent	10.1 Grades or Purity: 85 1003
1	10.2 Storage Temperature: Ambient
i	10.3 Inert Atmosphere: No requirement
	10.4 Venting: Open (flame arrester) or pressure-sacuum
ì	
	}
11. HAZARD ASSESSMENT CODE	13. PHYSICAL AND CHEMICAL PROPERTIES
See Mazard Assessment Haridbook CG 446-3)	13.1 Physical State at 15°C and 1 atm: I iquid
A-P-Q	13.2 Molecular Weight: XX II
	13.3 Boiling Point at 1 atm: 171°1 = 77°C = 350°K
ļ	13 4 Freezing Point:
12. HAZARD CLASSIFICATIONS	-117°F = -x3°C = 190°K
12.1 Code of Federal Regulations:	13.5 Critical Temperature: 482°F = 250°C = 523°K
Flammable liquid 12.2 NAS Hazard Reting for Bulk Water	13 6 Critical Pressure:
Transportation:	558 psia = 38 atm = 3.8 MN/m/
Category Reting	13.7 Specific Gravity: 0.902 at 20.0 (figure) 13.8 Liquid Surface Tension:
Fire 3 Health	13.8 Liquid Surface Tension: 24 dynesicm = 0.024 N im at 20°C
Vapor Irritant 1	13 9 Liquid-Water Interfacial Tension:
Liquid or Solid Erritant 1 Poisons 2	6.79 dynes/cm = 0.00679 N/m at 30 °C 13.10 Vapor (Gas) Specific Gravity: 3.0
Water Pollution	13.10 Vapor (Gas) Specific Heats of Vapor (Gas):
Human Toxicity 1 Aquatic Toxicity 2	1 080
Aesthetic I ffect 2	13.12 Latent Heat of Vaporization:   158 Btu: lb = 87 6 cal   g = 3.67 × 10° J, kg
Reactivity Other Chemicals	13.13 Heat of Combustion: -10.110 Big lb
Water 0	= -5616 cal/g = -235 1 × 10° J/kg
Self-Reaction 0	13.14 Heat of Decomposition: Not perturent
12 3 NFPA Hazard Classifications: Category Classification	13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymerization: Not pertinent
Health Hazard (Blue)	
Flammability (Red) 3 Reactivity (Yellow) 0	
Reactivity ( ) enow;	
	it instruct on pages 5 and 6
NO	TES

# ETHYL ALCOHOL

Commor Synon Ethasol Alcohol Grain alcohol Denatured alcohol	Yns Watery liquid	Colorless Alcohol odor	
	produced.	with water. Flammable, irritating vapor is	
Stop dischar Shut off ign Stay upwinc Isolate and Notify local	rge if possible. Keep people awa ition sources and call fire depar I and use water spray to "Knock remove discharged material. health and pollution control ag	y. iment. down" vapor. dencies.	
FLAMMABLE Flashback along vapor (rail Vapor may explode of ignite Extinguish with dry chemic Water may be ineffective of Cool exposed containers w		t in an enclosed area. il, alcohol foam, or carbon dioxide. fire.	
Exposure	CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose and th Move to fresh air. LIQUID Not harmful.		
Water Pollution	Dangerous to aquatic life in h May be dangerous if it enters Notify local health and wild! Notify operators of nearby w	water intakes. life officials.	
1 RESPON	SE TO DISCHARGE	2 LADEL	
1. RESPONSE TO DISCHARGE (See Response Memous Paradopa, CG 446-4) (Noue warning high flammability Disperse and flush			
3. CHEMICAL DESIGNATIONS 3.1 Synonyme: Alcohol Fe mentation alcohol Cologies parts Denatured alcohol Spirit Fithanol Spirits of wine 3.2 Coast Guard Competibility Classification: Nechol 3.3 Chemical Formula: C-BLOH 3.4 IMCO/United Nations Numerical Designation: 3.2 1170		4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (ac chipped): Liquid 4.2 Color: Colorles 4.3 Odor: Mild, rather pleasant, like wine of whiskes (Denatured alcohol max be unpleasant.)	
		H HAZARDS	
liquid and int	salation of vapors	canister, safety goggles. Avoid contact with	
occur Liquid	causes intoxication	eyes, nose and throat. Headache and drowsness may	
5.3 Treatment for E call physician water	ixposure: INHALATION if i administer oxygen. Speed is of	breathing is affected, remove victim to fresh air; I primary importance TYES OR SKIN, flush with	
	station (Threshold Limit Value		
	<b>alation Limits:</b> 5000 ppm for I <b>ation:</b> Grade (, LD <sub>is</sub> 5 to 15 g.		
5.7 Late Texicity: 1		cause a slight smarting of the eyes or respiratory	
system if pres	ent in high concentrations. The	effect is temporary	
5 9 Liquid or Solid 5 10 Odor Thrushold		appreciable hazard. Practically harmless to the skin	

6. FIRE HAZAROS	8. WATER POLLUTION
6.1 Flash Point: 55°E C C 64°E O C	8 1 Aquatic Toxicity:
6.2 Flammable Limits in Air: 3.3% 19%	250 ppm/6 hr/goldfish/lethal/tresh water
6.3 Fire Extinguishing Agents: Carbon	8.2 Wateriowi Toxicity: Data not available
dioxide, dry chemical, water spray.	8.3 Biological Oxygen Demand (BOD):
alcohol loam	125%, 5 days, 44 2% (theor.), 5 days,
6.4 Fire Extinguishing Agents Not to be Used:	71.2% (theor.) 20 days
None	8 4 Food Chain Concentration Potential:
6.5 Special Hexards of Combustion Products:	None
None	
6.6 Behavior in Fire: Not pertinent	
6.7 Ignition Temperature: 689°F	
6.8 Electrical Hazard: Class I, Group D	<del></del>
	9. SELECTED MANUFACTURERS
6.9 Burning Rate: 3.9 mm;min	1 Commercial Solvents Corp
	245 Park Ave
	New York, N. Y. 10017
	2 National Distillers and Chemical Corp.
	1. S. Industrial Chemicals Co. Division
	Tuscota, Itt 61953
	3 Publicker Industries, Inc.
7. CHEMICAL REACTIVITY	1429 Walnut St
7.1 Reactivity with Water: No reaction	Philadelphia, Pa. 19102
7.2 Reactivity with Common Materials:	1
No reaction	1
7.3 Stability During Transport: Stable	
7 4 Neutralizing Agents for Acids and	ì
Caustics: Not pertinent	i
7.5 Polymerization: Not pertinent	
7.6 Inhibitor of Polymerization: Not pertinent	16 CHIRDING INCORNATION
The manual of the state of the	10. SHIPPING INFORMATION
	10.1 Grades or Purity: Anhydrous (200)
	proof), 190 proof, specially denatured; completely denatured
	,
	10.2 Storage Temperature: Ambient
	10.3 Inert Atmosphere: No requirement
	10.4 Venting: Open (flame arrester or
	pressure-vacuum
11 HAZARD ACCCCCMENT CORE	12 DUNAIGNI AND DUCANGAL ADDRESS.
11. HAZARD ASSESSMENT CODE	13. PHYSICAL AND CHEMICAL PROPERTIES
(See Nazard Assessment Handbook, CG 446-3)	13.1 Physical State at 15°C and 1 atm:
	13.1 Physical State at 15°C and 1 atm: Liquid
(See Nazard Assessment Handbook, CG 446-3)	13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 46.07
(See Nazard Assessment Handbook, CG 446-3)	13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 46.07 13.3 Bolling Point at 1 atm:
(See Hazerd Assessment Handbook: CG 446-3) $A \cdot P \cdot Q \cdot R \cdot S$	13.1 Physical State at 15°C and 1 atm:
(See Mazerd Assessment Handbook CG 446-3)  A-P-Q-R-S  12. HAZARD CLASSIFICATIONS	13.1   Physical State at 15°C and 1 atm:   Liquid
(See Hazerd Assessment Handbook: CG 446-3) $A \cdot P \cdot Q \cdot R \cdot S$	13.1   Physical State at 15°C and 1 atm:   Equal
(See Mazerd Assessment Handbook CG 446-3) A-P-Q-R-S  12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable Iquad	13.1   Physical State at 18°C and 1 atm:
12. HAZARD CLASSIFICATIONS  12. Code of Federal Regulations: Flammable liquid  12. NAS Hazard Rating for Bulk Water	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   17.9 °F = 78.3°C = 351.5°K     13.4   Freezing Point:
12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12. Lammable liquid  12. NAS Hazard Rating for Bulk Water Transportation:	13.1   Physical State at 18°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:
12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12. Lammable liquid	13.1   Physical State at 18°C and 1 atm:   Liquid       13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:
12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12. Lammable liquid  12. NAS Hazard Rating for Bulk Water Transportation:	13.1   Physical State at 18°C and 1 atm:
12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12. Code of Federal Regulations: Flammable liquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Boiling Point at 1 atm:   172.9°  = 78.3° C = 351.5° K     13.4   Freezing Point:   -173°  = -114° C = 159° K     13.5   Critical Temperature:   46.0°  = 243.1° C = 516.3° K     13.6   Critical Pressure:   92.0° pia = 6.0° atm = 6.0° A M.N. m²     13.7   Specific Gravity: 10.70° at 26° C Cidquid     13.8   Liquid Surface Tension: Not pertinent
12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable Iquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant I	13.1   Physical State at 18°C and 1 atm:   I i i i i i i i i i i i i i i i i i i
12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable liquid  12.2 MAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3  Health Vapor Irritant Liquid of Solid Irritant Liquid of Solid Irritant Liquid of Solid Irritant 0	13.1   Physical State at 15°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.9°  = 77.3° C = 35   5° K     13.4   Freezing Point:   -171°  = -114° ( = 159° K     13.5   Critical Temperature:   469.6°  = 233.1° C = 516.3° K     13.6   Critical Pressure:   92.9 ps.s = 6.0 atm = 6.36 MN mill     13.7   Specific Gravity: 0.790.at.20 C (fiquid)     13.8   Liquid Surface Tension:   Not pertinent     13.9   Liquid Water Interfacial Tension:   Not pertinent     13.9   Liquid Water Interfacial Tension:   Not pertinent
12. HAZARD CLASSIFICATIONS  12. Code of Federal Regulations: Hammable Injure  12. NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Lyund to Schild Irritant 0 Porsons 1	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Solling Point at 1 atm:
12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant I Liquid of Solid Irritant 0 Poison I Water Pollution	13.1   Physical State at 15°C and 1 atm:   I i i i i i i i i i i i i i i i i i i
12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable liquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Laguid of Solid Irritant 0 Poisons 1 Water Pollution Human Toxicity 1	13.1   Physical State at 15°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.9°  = 78.3° C = 351.5° K     13.4   Freezing Point:   -173°  = -114° C = 159° K     13.5   Critical Temperature:   460.6°  = 233.1° C = 516.3° K     13.6   Critical Pressure:   92.0 pt.  = 6.36 M.N. m;     13.7   Specific Gravity: 0.790.ar 20. C (figurid)     13.8   Liquid Surface Tension: Not pertinent     13.9   Liquid-Water Interfacial Tension: Not pertinent     13.10   Vepor (Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Heats of Vapor (Gas):   1.28
12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant I Liquid of Solid Irritant 0 Poison I Water Pollution	13.1   Physical State at 15°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.9°  = 78.3° C = 351.5° k     13.4   Freezing Point:   -173°  = -114° C = 150° k     13.5   Critical Temperature:   40.0°  = 243.1° C = 516.3° k     13.6   Critical Temperature:   92.0 pts  = 6.3 6.4 m = 6.3 6.4 m m     13.7   Specific Gravity: 0.790.8° C ( Liquid )   13.8   Liquid Surface Tension: Not pertinent     13.9   Vegoc ( Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Heats of Vapor (Gas):   1.128     13.12   Latent Heat of Vapor (Station: 1.128     13.13   Latent Heat of Vapor (Station: 1.128     13.14   Latent Heat of Vapor (Station: 1.128     13.15   Latent Heat of Vapor (Station: 1.128     13.16   Latent Heat of Vapor (Station: 1.128     13.17   Latent Heat of Vapor (Station: 1.128     13.18   Latent Heat of Vapor (Station: 1.128     13.19   Latent Heat of Vapor (Station: 1.128     13.10   Latent Heat of Vapor (Station: 1.128     13.11   Latent Heat of Vapor (Station: 1.128     13.12   Latent Heat of Vapor (Station: 1.128     13.12   Latent Heat of Vapor (Station: 1.128     13.12   Latent Heat of Vapor (Latent Heat of Vapo
12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable liquid  12.2 NAS Hazard Rating for Bulk Water Transportation:  Category Rating Fire 3  Health Vapor Irritant 1 Liquid of Solid Irritant 0 Possons 1  Water Pollution Human Toxicity 1 Aquater Toxicity 1	13.1   Physical State at 15°C and 1 atm:
12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable injud  12.2 NAS Hazard Reting for Bulk Water Transportation: Category Reting Fire 3 Health Vapor Irritant 1 Liquid of Solid Irritant 0 Possons 1 Water Pollution Human Toxicity 1 Aquater Toxicity 1 Acsibetic Lifect 1 Reactivity Other Chemicals 2	13.1   Physical State at 15°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.9°F = 78.3°C = 351.5°K     13.4   Freezing Point:   -   172°F = -  181°C = 159°K     13.5   Critical Temperature:   400.6°F = 233.1°C = 516.3°K     13.6   Critical Pressure:   920.psia = 63.0 atm = 6.38 MN mir.   13.7   Specific Gravity: 0.790.a.7.0 C. Citiquid:   13.8   Liquid Surface Tension: Not pertinent     13.9   Liquid Water Interfacial Tension:   Not pertinent     13.10   Vepoc (Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Hearts of Vepor (Gas):   1.28     13.12   Listent Neet of Vepor Light     13.13   Meet of Combustion:   -11.570   Bits (h)
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable liquid  12.2 NAS Mazerd Reting for Bulk Water Transportation: Category Rating Fire	13   Physical State at 15°C and 1 atm:   Liquid     13   Molecular Weight: 46.07     13   30 Milling Point at 1 atm:   172.9°   = 78.3° C = 351.5° k
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Reting Fire 3 Health Vaper Irritant 1 Liquid on Suid-Irritant 0 Possons I Water Pollution Human Towers 1 Aquatic Towers 1 Aquatic Towers 1 Reactivity Other Chemicals 2 Water 0 Self-Reaction 0	13.1   Physical State at 15°C and 1 atm:
12. HAZARD CLASSIFICATIONS  12.1 Gode of Federal Regulations: Flammable liquid  12.2 NAS Hazard Rating for Bulk Water Transportation:  Category Rating Fire 3  Health Vapor Irritant 1 Liquid of Solid Irritant 0 Poisons 1  Water Pollution Human Toxicity 1 Aquater Toxicity 1 Acsibetic Lifect 1  Reactivity Other Chemicals 2 Water 0 Self-Reaction 0  12.3 NPPA Hazard Classifications:	13.1   Physical State at 15°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.9°  = 78.3° C = 351.5° K     13.4   Freezing Point:   -174° C = 150° K     13.5   Critical Temperature:   400.6°  = 233.1° C = 510.3° K     13.6   Critical Temperature:   920.91
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Reting Fire 3 Health Vaper Irritant 1 Liquid on Suid-Irritant 0 Possons I Water Pollution Human Towers 1 Aquatic Towers 1 Aquatic Towers 1 Reactivity Other Chemicals 2 Water 0 Self-Reaction 0	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.0°   = 78.3° C = 351.5° k     13.4   Freezing Point:   -173°   = -114° C = 150° k     13.5   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.6   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.7   Specific Gravity: 0.700.3° Det ( (iquid)     13.8   Liquid Surface Tension: Not pertinent     13.9   Vapor (Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Heats of Vapor (Gas):   1.128     13.12   Latent Heat of Vaporization:   360.8° Liquid Specific Heats of Vapor (Gas):   1.138     13.14   Heat of Combustion: -11,570.8° Li lip   -42° Cal.9° = 2-38 × X (0° J. kg     13.14   Heat of Decomposition: Not pertinent     13.15   Heat of Solution: -99.8° Li lip   18   18   18   18   18   18   18   1
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Hammable Inquid  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Reting Fire 3 Health Vapor Irritant 1 Liquid on Suid-Irritant 0 Possons 1 Water Pollution Human Tovicity 1 Aquatic Tovicity 1 Aquatic Tovicity 1 Reactivity Cher Chemicals 2 Water 0 Netf-Reaction 0  12.3 NFPA Hazard Classifications: Category Classification  Category Classification  12.3 NFPA Hazard Classifications: Category Classification Hazard Ribert 0	13.1   Physical State at 15°C and 1 atm:   Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.9°  = 78.3° C = 351.5° K     13.4   Freezing Point:   -174° C = 150° K     13.5   Critical Temperature:   400.6°  = 233.1° C = 510.3° K     13.6   Critical Temperature:   920.91
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Reting for Bulk Water Transportation: Category Reting Fire 3 Health Vapor Irritant 1 Lagand or Solid Irritant 0 Poscons 1 Water Pollution Human Toxicity 1 Acquite Toxicity 1 Acquite Toxicity 1 Reactivity Other Chemicals 2 Water 0 Self-Reaction 0 12.3 NFPA Hazard Classifications: Category Classification Health Hazard (Blue) 0 Health Hazard (Blue) 1	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.0°   = 78.3° C = 351.5° k     13.4   Freezing Point:   -173°   = -114° C = 150° k     13.5   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.6   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.7   Specific Gravity: 0.700.3° Det ( (iquid)     13.8   Liquid Surface Tension: Not pertinent     13.9   Vapor (Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Heats of Vapor (Gas):   1.128     13.12   Latent Heat of Vaporization:   360.8° Liquid Specific Heats of Vapor (Gas):   1.138     13.14   Heat of Combustion: -11,570.8° Li lip   -42° Cal.9° = 2-38 × X (0° J. kg     13.14   Heat of Decomposition: Not pertinent     13.15   Heat of Solution: -99.8° Li lip   18   18   18   18   18   18   18   1
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Injund  12.2 NAS Hazard Rating for Bulk Water Transportation: Category Reting Fire 3  Health Vapor Irritant 1 Liquid of Solid Irritant 0 Possons 1 Water Pollution Human Toxicity 1 Aquatic Toxicity 1 Acubet Iffect 1 Reactivity Chief Chemicals 2 Water 0 Self-Reaction 0 12.3 NFPA Hazard Classifications: Category Classifications: Category Classifications: Category Classification Hath Hazard (Bibet 0)	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.0°   = 78.3° C = 351.5° k     13.4   Freezing Point:   -173°   = -114° C = 150° k     13.5   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.6   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.7   Specific Gravity: 0.700.3° Det ( (iquid)     13.8   Liquid Surface Tension: Not pertinent     13.9   Vapor (Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Heats of Vapor (Gas):   1.128     13.12   Latent Heat of Vaporization:   360.8° Liquid Specific Heats of Vapor (Gas):   1.138     13.14   Heat of Combustion: -11,570.8° Li lip   -42° Cal.9° = 2-38 × X (0° J. kg     13.14   Heat of Decomposition: Not pertinent     13.15   Heat of Solution: -99.8° Li lip   18   18   18   18   18   18   18   1
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Reting for Bulk Water Transportation: Category Reting Fire 3 Health Vapor Irritant 1 Lagand or Solid Irritant 0 Poscons 1 Water Pollution Human Toxicity 1 Acquite Toxicity 1 Acquite Toxicity 1 Reactivity Other Chemicals 2 Water 0 Self-Reaction 0 12.3 NFPA Hazard Classifications: Category Classification Health Hazard (Blue) 0 Health Hazard (Blue) 1	13.1   Physical State at 15°C and 1 atm:   I i i i i i i i i i i i i i i i i i i
12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Inquid  12.2 NAS Hazard Reting for Bulk Water Transportation: Category Reting Fire 3 Health Vapor Irritant 1 Lagand or Solid Irritant 0 Poscons 1 Water Pollution Human Toxicity 1 Acquite Toxicity 1 Acquite Toxicity 1 Reactivity Other Chemicals 2 Water 0 Self-Reaction 0 12.3 NFPA Hazard Classifications: Category Classification Health Hazard (Blue) 0 Health Hazard (Blue) 1	13.1   Physical State at 15°C and 1 atm: Liquid     13.2   Molecular Weight: 46.07     13.3   Bolling Point at 1 atm:   172.0°   = 78.3° C = 351.5° k     13.4   Freezing Point:   -173°   = -114° C = 150° k     13.5   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.6   Critical Temperature:   40.0°   = 243.1° C = 516.3° k     13.7   Specific Gravity: 0.700.3° Det ( (iquid)     13.8   Liquid Surface Tension: Not pertinent     13.9   Vapor (Gas) Specific Gravity: 1.6     13.11   Ratio of Specific Heats of Vapor (Gas):   1.128     13.12   Latent Heat of Vaporization:   360.8° Liquid Specific Heats of Vapor (Gas):   1.138     13.14   Heat of Combustion: -11,570.8° Li lip   -42° Cal.9° = 2-38 × X (0° J. kg     13.14   Heat of Decomposition: Not pertinent     13.15   Heat of Solution: -99.8° Li lip   18   18   18   18   18   18   18   1

# ETHYLENE GLYCOL

Common Synonyi Glycol Manaethylene glycol 1,2-Ethanediol	Thick liquid	Colorles	Ownless		
	Sinks and mixes wi	th water.			
Stop discharge if possible.					
Call fire department.  Isolate and remove discharged material.  Notify local health and pollution control agencies.					
Fire	Combustible. Extinguish with dry chemical Water may be ineffective on I Cool exposed containers with	, alcohol foam, or carbon dioxi ire. water.	de.		
or milk and have victing		of consciousness.  Ig and shoes.  Ity of water.  In and flush with plenty of water  In cONSCOUS, have victim of  induce vonditing.  Is UNCONSCOUS OR HAVIN  except keep victim warm.	or. Ink water G CON-		
Water Water  Effect of low concentrations on aquatic life is unknown.  May be dangerous if it entern water intakes.  Notify local health and widdlife officials.  Notify operators of nearby water intakes:					
1. RESPONS	E TO DISCHARGE	2. LAB			
· · · · ·	nods Handbook CG 446-4)				
Disperse and fl	ush	No hazard label Code of Federal			
3 CHEMICA	L DESIGNATIONS	4. OBSERVABLE CH	APACTERISTICS		
	Dihydroxyethane	4.1 Physical State (as sh			
	2-Ethanediol hylene dihydrate	4.2 Color: Colorless			
Gl	veol	4.3 Oder: Slight oder			
	onoethylene glycol impatibility Classification:				
	ycol ula: HOCH-CH-OH				
	ations Numerical				
		1 HAZARDS			
5 1 Personal Protec		wer and eye hath			
	rwing Exposure: Inhalation o etimes leading to fatal kidney in		on causes stupor		
5.3 Treetment for E	EPOCUTO: INGESTION induc		SKIN AND		
EYES flush with water					
	letten (Threshold Limit Value	Mag 001 pm	5.4 Toxicity by Inhalation (Throshold Limit Value): 100 ppm 5.5 Short-Torm Inhalation Limits: Not pertinent		
5.4 Toxicity by inhe 5.5 Short-Term inh	alation Limits: Not pertinent				
5.4 Toxicity by Inhe 5.5 Short-Torm inh 5.6 Toxicity by Inge	eletion Limite: Not pertinent etions: Grade I, LD <sub>0</sub> 5 to 15 g)	(kg (rat, guinea pig, mouse)			
5.4 Toxicity by Inha 5.5 Short-Term Inh 5.6 Toxicity by Inge 5.7 Late Texicity: F	<b>alation Limits:</b> Not pertinent <b>action:</b> Grade 1, LD <sub>10</sub> 5 to 15 g <sub>2</sub> fatal kidney injury may result if	(kg (rat, guinea pig, mouse)	i throat		
5.4 Toxicity by inha 5.5 Short-Term inh 5.6 Toxicity by Inge 5.7 Late Texicity: F 5.8 Vaper (Gae) Irri	alation Limita: Not pertinent action: Grade 1, 1.Do 5 to 15 g/ fatal kidnes injury may result if tant Characteristics: Vapors iritant Characteristics: No 2	kg (rat, guinea pig, mouse) ingested are nonirrilating to the eyes and			

6. FIRE HAZARDS 6.1 Flash Point: 240°F O.C. 222°F C.C. 6.2 Flammable Limits in Air: 111 = 3.25°, C.F. 11 not histed 6.3 Fire Estinguishing Agents: W. techny alcohol foam carbon dioode, or dosoholic characteristics of the Estinguishing Agents Not to be Used: Water or foam mary cause forthing 6.5 Special Hazards of Combustion Products: Not pertinent	8. WATER POLLUTION  8.1 Aquetic Toxicity: > 100 ppm 48 hr shrings 1.0 w satt water  8.2 Waterlowd Toxicity: Data not available  8.3 Biological Oxygen Demand (BOD): 12.5% (theor): 3 days. 78% (theor): 20 days.  8.4 Food Chein Concentration Potential: None
67 Ignition Temperature: "S   68 Electrical Mazard: Not perform 69 Burning Rate: 10 min. min 7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: Not caction 7.2 Reactivity with Common Materials: Note stion 7.3 Stability During Transport: Nable 7.4 Neutralizing Agents for Acids and Caussidis: Not perform	9. SELECTED MANUFACTURERS  1 Dow Chemical Co- Midland Mich 48640  2 PPG Industries, Inc. Chemical Division Guasanilla, Paertu Rico 00/56  1 Inon Carbide Corp. Chemicals and Plastics Division 270 Park Ase. New York, N. Y. 19017
7.5 Polymerization: Not pertunent 7.6 Inhibitor of Polymerization: Not pertunent	10. SHIPPING INFORMATION  10.1 Grades or Purity: Industrial grade low conductivity grade  10.2 Storage Temperature: Anthent  10.3 Inert Atmosphere: No requirement  10.4 Venting: Open (flame arrester)
11. HAZARD ASSESSMENT CODE	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: 1 iquid
A-P-Q	13.2 Molecular Weight: 62.07 13.3 Boiling Point at 1 atm: 387.71 = 197.6 C = 470.8 K 13.4 Freezing Point: 5.6 L = -131.6 = 3005.6
12. HAZARD CLASSIFICATIONS	13.5 Critical Temperature: Not pertonent
12.1 Code of Federal Regulations: Not listed	13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 1 (15 at 20°C (hquid)
12.2 NAS Hazard Rating for Bulk Water Transportation:	13.8 Liquid Surface Tension: Not pertinent
Category Rating Fire I	13.9 Liquid-Water Interfacial Tension: Not pertinent
Health	13 10 Vapor (Gas) Specific Gravity: Not pertinent
Vapor Tristant 0 Liquid or Solid Tristant 0	13 11 Ratio of Specific Heats of Vapor (Gas):
Poisons I Water Pollution	13 12 Latent Heat of Vaporization:
Human Toxicity 2 Aquatic Toxicity 1	344 Biu th = 191 cat g = 8.00 × 10° J kg 13.13 Heat of Combustion: ~7259 Biu th
Aesthetic Effect 1 Reactivity	= -4033 cal/g = -168.9 × 105.5 kg 13.14 Heat of Decomposition: Not pertinent
Other Chemicals 2 Water 0	13 15 Heat of Solution: (est 3 ~ 20 Big 1h
Self-Reaction 0	= -12 callg = -0 5 x 10 J kg 13 16 Heat of Polymerization: Not pertinent
12.3 NFPA Hazard Classifications:  Category Classification	
Health Hazard (Blue)	
Flammability (Red)   1 Reactivity (Yellow)   0	
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
	(Continued on pages 1 and 6)
N(	DIES

# GASOLINES: AUTOMOTIVE

Stop dischary Shu off ago Shu off ago Suy upwind Isolate and re Notify local	Watery is quid Col	plories to pale brown or pink — Gasoline odor menable, unitating vapor is produced	6. FIRE HAZARDS 6.1 Flesh Point. 16.1.C.C. 6.2 Flemmtable Limits in Air: 1.4	8. WATER POLLUTION 8.1 Aquatic Toxicity:  90 ppm 24 hr passents American shad 11 m (techwater 91 mg 1, 24 hr passents American shad 11 m salt water 8.2 Waterfowt Toxicity: Data more antable 8.3 Biological Oxygen Demand (BOD): A > Mass 8.4 Food Chain Concentration Potential: None
Fire	FLAMMABLE. Flashback along vapor trail may Vapor may explode if ignited in Extinguish with dry chemical. Water may be ineffective on fu Cool exposed containers with the	n an enclosed area. , foam, or carbon dioxide. îre.	67 Ignition Temperature: ASA 1 68 Electrical Mazard: Class Caroup D 69 Burning Rate: 4 ann. man	9. SELECTED MANUFACTURERS  1. Lyxon Co. 30. Rocketcher Plaza Now York N. Y. (1002)  2. Shell Chi Co. 1. Shell Plaza Houston, Lyxos 27001
Exposure			7. CHEMICAL REACTIVITY 7.1. Reactivity with Water: Norcestion 7.2. Reactivity with Common Materials: Norcestion 7.3. Stability During Transport: Nublc 7.4. Neutrabing Agents for Acids and Caustics: Not perturen 7.5. Polymerization: Not perturen	3 Sun Ori Co St. Davids Pa. 1908*
Water Pollution	IF SWALLOWED and victim is or milk. DO NOT INDUCE VOMITING	ity of water.  a and flush with plenty of water.  b CONSCIOUS, have victim drink water  G.  FE IN VERY LOW CONCENTRATIONS  water intakes.  fe officials.	7.6 inhibitor of Polymerization: Not excluded	10. SHIPPING INFORMATION  10.11 Grades or Purity: National state ratings militars specifications.  10.2 Storage Temperature: Notice of Inert Atmosphere: No requirement.  10.3 Inert Atmosphere: No requirement.  10.4 Venting: Open (flame arrester) or pressure sacuum.
iSe∉ Response M	NSE TO DISCHARGE  Wethods Handbook CG 446 4)  ig high Hammahilits  cd	2. LABEL	11. HAZARD ASSESSMENT CODE  See Mazard Assessment Mandbook CG 446-35  A-T-1-V-W	13. PHYSICAL AND CHEMICAL PROPERTIES   13.1   Physical State at 15°C and 1 atm:   Liquid   13.2   Molecular Weight: Not perforced   13.3   Boiling Point at 1 atm:   140   200   1
3.1 Synonyme: M Pc 3.2 Coest Guerd 6 Miscellaned 3.3 Chemical For	compatibility Classification: ous hydrocarbon mixtures rmula: (Mixture of hydrocarbons i Nationa Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): 1 iquid 4.2 Color: (idorless to brown 4.3 Odor: Gasoline	12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable liquid  12.2 NAS Hazard Rating for Bulk Water Transportation:  Category Rating  Fire 3  Health Vapor Irritant Flaund or Solid Irritant Poisons  Water Pollution Human Loxets	13.5 Critical Temperature: No extinent 13.6 Critical Pressure: No extinent 13.7 Specific Gravity: 0.732 at 20°C (Equid) 13.8 Liquid Surface Tension: 09 23 dones on = 0.039 (0.023 N m at 20°C 13.9 Liquid-Water Interfacial Tension: 49 31 dones on = 0.049 0.033 N m at 20°C 13.10 Vapor (Gas) Specific Gravity: 3.4 13.11 Ratio of Specific Heats of Vapor (Gas): (cct. 1.004 13.12 Latent Heat of Vaporization:
5.1 Personal Prof. 5.2 Symptoms For depression in constitute large, it will be to be discussed by the constitution of the cons	nective Equipment: Protective a offorming Exposure: Frontanon of offering forces and the Health and a mineral exposure of the difference exercinstation conclude curronna and promontor. Swallow curronna and promontor. Swallow of Exposure: INTALATION in figure to intense. UNION in- tense of the exposure is a substantial public processible quantities is willow published with white sognant with wheletion (Threshold Limit Value	transons occubanges and simulation followed by imports upon new door, uses dizzness headach, and adectar some and expertance arrest. If liquid enters is given pulmonars edgent, and, later signs of more to a cause insignal a heartheat.  The importance and administer oxygen, entore, for SCL tribes, consisting stomach should be havaged and LYES with with coponic quantity of water of.  So single LLV applies.	Aquata Invests 2 Avestheric Hect 2 Reactivity Other Chemicals 0 Water 0 Self-Reaction 0 12 3 NFPA Hazard Classifications: Category Classification Health Hazard Effice 1 Lamabhita (Red) 3 Reactivity (Yellow) 0	10   15 (18) u th = "1   St. at y = 10   3.4 x   10   1   ky     13   13   Heat of Combustion: - 18   720 Btu   th = -10   400 c.d. y = -43 x   10   1   ky     13   14   Heat of Ecomposition: Not pertinent     13   15   Heat of Solution: Not pertinent     13   16   Heat of Polymerization: Not pertinent     Continued in page 25 and 5
5 6 Toxicity by in 5 7 Late Toxicity: 5 8 Vapor (Gas) I system (I pu 5 9 Liquid or Soli	Irritant Characteristics: Vapors sesent in high concentrations. The lid Irritant Characteristics: Min avecuse smarting and reddening of	e ke scance a slight smarring of the executivespiratory gethect of emporary minimin hazard. It spilled so clothing and allowed to	MC	OTES

# GASOLINES: AVIATION ( < 4.869 lead/gal)

Watery liquid Red, blue, green, brown or purple Floats on water. Flammable, irritating vapor is produced Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Stay upwind and use water spary to "knock down" vapor. Isolate and cemove discharged material. Notify local health and pollution control agencies. FLAMMABLE.
Flashback along vapor trail may occur
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam or carbon dioxide
Water may be ineffective on fire.
Cool exposed containers with water. Fire CALL FOR MEDICAL AID. VAPOR VAPOR irritating to eyes, nose and throat. If inhaled will cause dizziness, headache, difficult breathing or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIOUID LIQUID
Intating to skin and eyes.
If swallowed, will cause nauses or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water. Exposure or milk.
DO NOT INDUCE VOM! ING. HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Water Fouling to shoreline.

May be dangerous if it enters water intakes.

Notify local health and wildlife officials.

Notify operators of nearby water intakes. **Pollution** 1. RESPONSE TO DISCHARGE 2. LABEL Issue warning high flammability Evacuate area Disperse and flush 3. CHEMICAL DESIGNATIONS 4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): 1 iquid Synonyma: No compton synonyma 3.2 Coast Guard Compatibility Classification: 4.2 Color: Red blue, green, brown, Miscellaneous hydrocarbon mixtures purple 3.3 Chemical Formula: Not perforent 4.3 Odor: Gasoline 5. HEALTH HAZAROS mt: Protective goggles, gloves 5.2 Symptome Pollowing Exposure: INHALATIONs assess critation of upper respirators tract, central nervice system stimulation followed by depression of varying depress ranging from dizzness, headache, and incoordination to anesthesis, coma, and respirators arrest irregular, earthean schangerous complication. ASPIRATION causes seene lump tritation. with coughing gagging, dispined, substernal distress, and rapidly developing pulmonars edema, later sign. I bronchopingumona and pneumonitis, acute onset of central nervois sistem excitement followed by depression. FOR SEION causes tritition of mucous membranes of throat esophiagus, and stomach, stimulation followed by depression of central nervous system, irregular heartheat 5.3 Treatment by Exposure: Seek medical attention. INHALATION: maintain respiration, give oxygen if needed. ASPIRATION: enforce hed rest, administer oxygen. INGESTION: do. NOT induce vomiting, lavage carefully of appreciable quantity was injected, guard against appraision into lains. FVTS wash with copous quantity of water SKEN wipe off and wash with soap and water. 5.4 Toxicity by Inhalation (Threshold Limit Value): No single [] V applicable 5.5 Short-Term Inhelation Limits: 500 ppm for 10 min

5.6 Toxicity by Innestion: Grade 2.1 Da 0.5 to 5.8 kg

37 Late Fexicity: None

	6. FIRE HAZARDS		ļ	8. WATER POLLUTION			
61	Flash Point: 50°1: (- (		81 A	Aquetic Toxicity:			
6 2	Flammable Limits in Air:		!	90 ppin 24 hr juvenile American shad			
	1.2% 7.4%		į	II in Tresh water			
63	Fire Extinguishing Agents: 1 o	am.	1	9) ppm 24 hr invenite American shad			
	carbon dioxide dry chemical		I L <sub>in</sub> , salt water  8.2 Waterlow! Toxicity:				
6 4	Fire Extinguishing Agents Not	to be Used:	82	Data not available			
	Water may be meffective		83 8	Siological Oxygen Demand (BOD):			
6 5	Special Hazards of Combustic	on Products:	8.5 States (BOD):				
	None		8 4 Food Chain Concentration Potential:				
66	Behavior in Fire: Vapor is licas		• • •	Note			
	air and may travel a consider.		1				
	distance to a source of ignition thash back	n and					
6 7	Ignition Temperature: ×24°7		1	9. SELECTED MANUFACTURERS			
	Electrical Hazard: ( lass l. year	()	1 1	exon Ca			
69	Burning Rate: 4 mm/mm	41.11	30 Rocketeller Plaza				
09	burning rate. 4 mm/mm		New York N Y 10020				
			2 Shell Oil Co				
				Shell Plaza ouston Texas 2000			
			3	in Oil Co.			
	7. CHEMICAL REACTIVIT	rv		in Oil Co   Davids Pa (1908)			
71			! "	accepted to the second			
	Reactivity with Water: No reac		1				
7 2	Reactivity with Common Male No reaction	rrais:					
7.3		. No. 1					
	Stability During Transport: N						
7 4	Neutralizing Agents for Acids Caustics: Not permient	eriO	İ				
7.5	Polymerization: Not pertinent		t				
	Inhibitor of Polymerization:						
76	Not perturent		}	10. SHIPPING INFORMATION			
	via perimena		10 1	Grades or Purity: Grade 80 87			
			1	100-130 and FIS 145 Specific near			
			1	MIL G 88720			
			10 2	Storage Temperature: Ambient			
			10.3	to and discourant area. A			
				Inert Atmosphere: Neireuuricment			
			1	Venting: Open (flame arresters or pressure vacuum			
	11 HA7ADD ACCCCCMENT	CODE	10 4	Venting: Open (flame arrester) or pressure vacuum			
	11. HAZARD ASSESSMENT		10 4	Venting: Open claims are correct pressure vacuum  Pressure vacuum  PHYSICAL AND CHEMICAL PROPERT			
	See Hazard Assessment Handborn		10 4 13.	Venting: Open chame uncertained pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm: 1			
			13. 13.1 13.2	Venting: Open chame uncorer on pressure vacuum  PHYSICAL AND CHEMICAL PROPERT  Physical State at 15°C and 1 atm; 1.  Molecular Weight: Not py force.			
	See Hazard Assessment Handborn		10 4 13.	Venting: Open chame an exercise pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm: 1. Molecular Weight: Not py count Boiling Point at 1 atm: (eac. 34c.)			
	See Hazard Assessment Handborn		13. 13.1 13.2 13.3	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm. 1. Molecular Weight: Non-proton Molecular Weight 1 atm. 1. Molecular Wei			
	(See Hazard Assessment Handborn ) A-T-U-A-W		13. 13.1 13.2	Venting: Open chame uncercompressor execution  PHYSICAL AND CHEMICAL PROPERT  Physical State at 15°C and 1 atm; 1:  Molecular Weight: Not py from  Boiling Point at 1 atm; 1:01 - 140 1 1  10.11 170 - 25 - 244 - 444 K  Freezing Point:			
	Gee Mazard Assessment Handburg A-T-U-X-W  12. HAZARD CLASSIFICATI	ONS	13. 13 t 13 2 13 3	Venting: Open chame an exercise present evacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1: Molecular Weight: Not performs Boiling Point at 1 atm; 1:ee 134 it 1 atm; 1:ee 34 it 44 it K Freezing Point:  - 10 (1 = 24 4 it 2 = 29° / r. k)			
12 1	See HAZARD ASSESSMENT NATIONAL ASSESSMENT NATIONAL ASSESSMENT NATIONAL ASSISTED NATIONAL ASSIST	ONS	13. 13.1 13.2 13.3 13.4 13.5	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm. 1: Molecular Weight: Non primm Boiling Point at 1 atm. 1: Molecular Weight: Add 1 atd. 1: Molecular Weight: Add 44 k  Freezing Point:  - 7			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammabic haud	ONS	13. 13.1 13.2 13.3 13.4 13.5 13.6	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm: 1- Molecular Weight: No perform to 1 atm: 1- Molecular Weight: No perform to 1 atm: 1- To 10°C at 144 444 K  Freezing Point:  Sin 1 = 5°C 44 C = 5°C 7°C K  Critical Temperature: No perform of 1 atm 1 atm. 1			
12 1	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lummable haud NAS Hazard Rating for Bulk V	ONS	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7	Venting: Open chame uncerceived present evacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1: Molecular Weight: Not pyronem Boiling Point at 1 atm; 1: A 10 1 2 2 3 4 4 4 4 4 4  Freezing Point: A 10 1 = <24 € € < < 0.00 € 6 6  Critical Temperature: Not pyronem Critical Temperature: Not pyronem Specific Gravity: 0.711 at 15°C (flour			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable highed NAS Hazard Rating for Bulk Transportation:	ONS ::	13. 13.1 13.2 13.3 13.4 13.5 13.6	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1: Molecular Weight: Not personal Boiling Point at 1 atm; 1: and 1 atm; 1			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable haud NAS Hazard Rating for Bulk 1 Transportation: Category	ONS Water	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7	Venting: Open chame uncereror pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm: 1- Molecular Weight: No perform Boiling Point at 1 atm: 100 - 300 L 100 100 100 c = 344 - 444 K  Freezing Point: <pre></pre>			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lamnable haud NAS Hazard Rating for Bulk 1 Transportation: Category Lire	ONS ::	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8	Venting: Open chame uncerceion presente vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1: Molecular Weight: Not py timen Boiling Point at 1 atm; 1:00 - 34° 1 i  10° 10° 10° 10° 13° 13° 144 k  Freezing Point:    < ``   1   < 2.4   C   < 2.07°   k  Critical Temperature: Not py timen  Critical Temperature: Not py timen  Specific Gravity: 0.711 at 15°C (fluin Liquid Surface Tension:   9   2.14 mes can ± 0.019 - 0.023 N   1.70° C			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk transportation: Category Line Health	ONS :: Water Rating	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non-pronom 1 atm; 1; 1 atm; 2 atm; 2 atm; 2 atm; 2 atm; 3 atm; 4 atm; 5 atm; 2 atm; 2 atm; 5 atm; 5 atm; 6 atm; 6 atm; 6 atm; 6 atm; 7 a			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable house NAS Hazard Rating for Bulk's Transportation: Category Line Health Vapor Irritant	ONS Water	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non-pronom 1 atm; 1; 1 atm; 2 atm; 2 atm; 2 atm; 2 atm; 3 atm; 4 atm; 5 atm; 2 atm; 2 atm; 5 atm; 5 atm; 6 atm; 6 atm; 6 atm; 6 atm; 7 a			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk transportation: Category Line Health	ONS Water Rating	13. 13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8	Venting: Open chame uncerceion presente vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1;  Molecular Weight: Not py from 1 atm; 1;  Molecular Weight: Not py from 1 atm; 1;  Cifical Properture: Not py from 1 atm; 1;  Critical Properture: Not py from 1 atm; 1;  Specific Gravity; 0.711 at 15°C (figure Liquid Surface Tension: 19 23 done con ± 0.00 ± 0.023 Not 20 to 1.00 ± 0.00			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk V Transportation: Category Lire Health Vapor Irritant Liquid or Salid Fricant	ONS Water Rating	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non promo and 1 atm; 1; Molecular Weight: Non promo and 1 atm; 1; Non promo and 1; Non pr			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk V Transportation: Category Fire Health Vajor Irritant Figured or Solid Britant Pursons Water Pollution Human Loxens	ONS ::	13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non promo and 1 atm; 1; Molecular Weight: Non promo and 1 atm; 1; Non promo and 1; Non pr			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable liquid NAS Hazard Rating for Bulk's Transportation: Category Fire Health Vapor Irritant Liquid or Solid Irritant Poissons Water Pollution Human Lovents Vignat	ONS Water Rating	13. 13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9	Venting: Open chame uncerceion presente vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1: Molecular Weight: Not pyronem Boiling Point at 1 atm; 1: Molecular Weight: Not pyronem Local Committee of the C			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk's Transportation: Category Lire Health Vapor Irritant Liquid or Solid Irritant Possons Water Follution Human Loxens Aquate Loxens Aquate Loxens Aquate Loxens Aquate Loxens Avestern Effect	ONS ::	13. 13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9	Venting: Open chame uncereion pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm: 1.  Molecular Weight: Not perform to 130°L at 15°C and 1 atm: 1.  Molecular Weight: Not perform to 130°L at 15°C atm. 1.  Freezing Point: 1 atm. 100°L at 15°C atm. 1.  Critical Pressure: Not perform to Critical Pressure: Not perform to 15°C atm. 1.  Specific Gravity: 0.71 at 15°C (figure Liquid Surface Tension: 10°C atm. 1.  10°C atm. 1			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Y Transportation: Category Fire Health Vapor Fritant Figurd or Solid Fritant Forsons Water Follution Human Lowers Agusts Lowers Agust Lowe	OMS  Water  Rating	13. 13. 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Na pythological state at 15°C and 1 atm; 1; Molecular Weight: Na pythological point; 43°4 4 °C at 43°4 °C atm 43°4			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable hand NAS Hazard Rating for Bulk's Transportation: Category Fire Health Vapor Irritant Liquid or Solid Britant Poissons Water Pollution Human Lowens Vigunt Lowens Vestera, Effect Reactivity Other Chemicals	Rating	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9 13.10 13.11	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: No pyrtonin Bolling Point at 1 atm; 1eer (30°L)  1 10°L; 10°L c = 144 434 K  Freezing Point:  1 10°L; 10°L c = 144 434 K  Freezing Point:  1 10°L; 10°L c = 144 434 K  Critical Temperature: No pyrtonen  Critical Pressure: No pyrtonen  Critical Pressure: No pyrtonen  Specific Gravity: 0.71 at 15°C (figur  Liquid Surface Tension:  10°L (30°L)  10°L			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Y Transportation: Category Fire Health Vapor Fritant Figurd or Solid Fritant Forsons Water Follution Human Lowers Agusts Lowers Agust Lowe	OMS  Water  Rating	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9 13.10 13.11	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: No pyrtonin Bolling Point at 1 atm; 1eer (30°L)  1 10°L; 10°L c = 144 434 K  Freezing Point:  1 10°L; 10°L c = 144 434 K  Freezing Point:  1 10°L; 10°L c = 144 434 K  Critical Temperature: No pyrtonen  Critical Pressure: No pyrtonen  Critical Pressure: No pyrtonen  Specific Gravity: 0.71 at 15°C (figur  Liquid Surface Tension:  10°L (30°L)  10°L			
122	12. HAZARD CLASSIFICATI Code of Federal Regulations: Hammable liquid NAS Hazard Rating for Bulk's Transportation: Category Lire Health Vapor Irritant Liquid or Solid Irritant Liquid or Solid Irritant Liquid or Solid Irritant Human Lovent Vignatic Lovent Vignatic Lovent Vestbeth Life() Reaction Other Chemicals Water Self Reaction	OMS  Rating  1  1  1  1  1  1  1  1  1  1  1  1  1	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.9 13.10 13.11	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPER! Physical State at 15°C and 1 atm: 1- Molecular Weight: No perform 1 atm: 1- Molecular Weight: No perform 2 atm: 1- Molecular Weight: No perform 3 atm: 1- Molecular Weight: No perform 3 atm: 1- To 10°C atm 3 atm: 1- To 10°C atm 3 atm: 1- Critical Pressure: No perform 1 atm: 15°C (figure 1 atm: 10°C) (figure 1 atm: 10°C			
	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable Inpud NAS Hazard Rating for Bulk's Transportation: Category Fire Health Vapor Irritant Liquid or Solid Britant Liquid or Solid Britant Poissons Water Pollution Human Lowen Vestfeta, Effect Reactions Other Chemicals Water Self Reactions NFPA Hazard Classifications	Rating 1 1 2 2 0 0 0 0 0	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.1 13.1 13.1 13.1 13.1 13.1 13.1	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPER! Physical State at 15°C and 1 atm: 1- Molecular Weight: No perform 1 atm: 1- Molecular Weight: No perform 2 atm: 1- Molecular Weight: No perform 3 atm: 1- Molecular Weight: No perform 3 atm: 1- To 10°C atm 3 atm: 1- To 10°C atm 3 atm: 1- Critical Pressure: No perform 1 atm: 15°C (figure 1 atm: 10°C) (figure 1 atm: 10°C			
122	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk of Transportation: Category Fire Health Vapor Irritant Figured or Solid Fritant Poissons Water Pollution Human Foccus Agnatic Foccus Agnatic Foccus Cotte Chemicals Water Self Reaction NFFA Hazard Classifications Category	Pating  Rating  1  1  1  1  1  1  1  1  1  1  1  1  1	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.1 13.1 13.1 13.1 13.1 13.1 13.1	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose Critical Temperatura: Non promose Critical Temperatura: Non promose Critical Temperatura: Non promose Specific Gravity; 0.711 at 15°C (figure Liquid Surface Tempion; 10°C) donor con a 0.00 molecular state atm 1 atm; 10°C (figure Liquid Surface Tempion; 10°C) donor con a 0.00 molecular state atm 20°C.  Vapor (Gas) Specific Heats of Vapor (Gas) Specific Heats of Vapor (Gas) Specific Heats of Vapor (Gas) Specific State atm; 10°C (Figure 1) atm; 10°C (			
122	12. HAZARD CLASSIFICATI Code of Federal Regulations: Hammable liquid NAS Hazard Rating for Bulk's Transportation: Category Fire Health Vapor Irritant Founds Water Pollution Human Lovens Vaport Livetis Other Chemicals Water Self Reaction NFPA Hazard Classifications Category Health Hazard Bussifications Category Health Hazard Bussifications	Rating 1 1 2 2 0 0 0 0 0	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.1 13.1 13.1 13.1 13.1 13.1 13.1	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm. 1. Molecular Weight Not by John M. State at 15°C and 2 atm. 1. Molecular Weight Not by John M. State at 15°C and 1 atm. 1. The person of the pe			
122	12. HAZARD CLASSIFICATI Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk of Transportation: Category Fire Health Vapor Irritant Figured or Solid Fritant Poissons Water Pollution Human Foccus Agnatic Foccus Agnatic Foccus Cotte Chemicals Water Self Reaction NFFA Hazard Classifications Category	ONS  Rating  1  1  1  1  Cleasification	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.1 13.1 13.1 13.1 13.1 13.1 13.1	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose Critical Temperatura: Non promose Critical Temperatura: Non promose Critical Temperatura: Non promose Specific Gravity; 0.711 at 15°C (figure Liquid Surface Tempion; 10°C) donor con a 0.00 molecular state atm 1 atm; 10°C (figure Liquid Surface Tempion; 10°C) donor con a 0.00 molecular state atm 20°C.  Vapor (Gas) Specific Heats of Vapor (Gas) Specific Heats of Vapor (Gas) Specific Heats of Vapor (Gas) Specific State atm; 10°C (Figure 1) atm; 10°C (			
122	12. HAZARD CLASSIFICATI Code of Federal Regulations: Lammable haped NAS Hazard Rating for Bulk's Transportation: Category Fire Health Vapor Irritant Liquid or Solid Britant Liquid or Solid Britant Liquid or Solid Britant Poissons Water Pollution Human Lowens Venter, Lifet Reactions Other Chemicals Water Self Reaction NPPA Hazard Classifications Category Health Hazard Classifications	Rating  1  1  2  1  1  2  1  1  2  1  1  2  1  1	13.1 13.1 13.2 13.3 13.4 13.5 13.6 13.7 13.8 13.1 13.1 13.1 13.1 13.1 13.1 13.1	Venting: Open chame uncerease pressure vacuum  PHYSICAL AND CHEMICAL PROPERT Physical State at 15°C and 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose state at 1 atm; 1; Molecular Weight: Non promose Critical Temperatura: Non promose Critical Temperatura: Non promose Critical Temperatura: Non promose Specific Gravity; 0.711 at 15°C (figure Liquid Surface Tempion; 10°C) donor con a 0.00 molecular state atm 1 atm; 10°C (figure Liquid Surface Tempion; 10°C) donor con a 0.00 molecular state atm 20°C.  Vapor (Gas) Specific Heats of Vapor (Gas) Specific Heats of Vapor (Gas) Specific Heats of Vapor (Gas) Specific State atm; 10°C (Figure 1) atm; 10°C (			

#### 5. HEALTH HAZARDS (Cont'd.)

- 5.8 Vapor (Gas) Irritant Characteristics: Vapors gause a slight smarting of the evec or respirators
- system of present in high concentrations. The effect is temporars

  5.9 Liquid or Boild Irritant Characteristics: Minimum hazard. It spilled on clothing and allowed to remain may cause smarting and reddening of the skin.
- 5.10 Oder Threshold: #25 pp. 5

#### **GASOLINE BLENDING STOCKS: ALKYLATES**

Common Synonyme 6. FIRE HAZARDS 8. WATER POLLUTION Watery liquid Colories 8.1 Aquetic Toxicity: 90 ppm/24 hr/juvende American shad 6.1 Flash Point: (b) 0:73°1 ( C II m/fresh water 91 ppm/24 hr/javenile American shad: Floats on water. Flammable, irritating vapor is produced 6.2 Flammable Limits in Air: 11 m/salt water (a) 1 15 8 75 op discharge if possible. Keep people away.

sut off ignition sources and call fire department.

sy upwind and use water spray to "knock down" vapor;
bate and remore discharged material.

ottly local health and pollution control agencies. 6.3 Fire Extinguishing Agents: Dry chemical, Joann, carbon dioxide 8 2 Waterlowi Texicity: Data not availab Siological Oxygen Demand (BOD): 874. 5 days 6.4 Fire Extinguishing Agents Not to be Used: Water may be mellective Food Chain Concentration Poten 6.5 Special Hazerds of Combustion Products: None FLAMMABLE.
Flushback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Estinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Coal exposed containers with water. 6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable 9. SELECTED MANUFACTURERS distance to a source of ignition and flash back Laronto Fire 30 Rockefeller Plaza New York, N. Y. 10020 Ignition Temperature: Data not available Shell Oil Co 6.8 Electrical Hazard: Class I, group D Shell Plaza 69 Burning Rate: 4 mm, mm Houston, Lev 2001 CALL FOR MEDICAL AID Sun Oil Co St. Davids Pa. 19087 VAPOR Iritating to eyes, nose and throat. If inhabed, will cause dizziness, headache, difficult breathing or loss of consciousness flower to freah as to pred, give artificial respiration. If breathing has topped, give artificial respiration. 7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable LIQUID
Initiating to skin and eyes.
If swallowed, will cause nauses and vomiting,
Remove contaminated clothing and shoes
Plash affected areas with plenty of water.
IP IN EYES, hold cyclic open and flush with plenty of water.
IP SWALLOWED and wittin in CONSCIOUS, have victim drink water. Neutralizing Agents for Acids and Caustics: Not pertinent Exposure 7.5 Polymerization: Not pertinent Inhibitor of Polymerization: 10. SHIPPING INFORMATION Not pertinent 10.1 Grades or Purity: Composition varies with range of distillation or milk.
DO NOT INDUCE VOMITING. temperatures used 10.2 Storage Temperature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Venting: Open (flame arrester) or HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. pressure vacuum MARMPUL TO AQUATIC LIFE IN VARIATION TO SHOP TO AQUATIC LIFE IN VARIATION TO A SHOP TO AQUATIC LIFE IN VARIATION TO AQUATIC LIFE IN VARIATION AND AQUATIC LI Water **Pollution** I. RESPONSE TO DISCHARGE 2. LABEL 11. HAZARD ASSESSMENT CODE 13. PHYSICAL AND CHEMICAL PROPERTIES See Response Methods Handbone, CG 446, 4 13.1 Physical State at 25°C and 1 atm: Liquid Four warning think flammability 4-1-C-V-W 13.2 Molecular Weight: Not pertinent 13.3 Boiling Point at 1 atm: 58 255 E = 14 135 C = 287 408 K 13.4 Freezing Point: Not perforent 12. HAZARD CLASSIFICATIONS 13.5 Critical Temperature: Not perforent Code of Federal Regulations: 3. CHEMICAL DESIGNATIONS 13.6 Critical Pressure: Not pertinent 4. OBSERVABLE CHARACTERISTICS Flammable hund 4.1 Physical State (as shipped): Liquid 13.7 Specific Gravity: 0.11 in Thanks to NAS Hazard Rating for Bulk Water 3.2 Coast Guard Compatibility Classification 4.2 Color: Calories. Transportation: 13.8 Liquid Surface Tension: 19 2.3 dones cm = (0.019 - 0.023 \infty \text{ max 20 C}) 4.3 Odor: traviline Category Rating 3.3 Chemical Formula; Not pertinent 13.9 Liquid-Water Interfacial Sension: 49 - 51 dyncs cm = 0.049 - 0.051 N/m 3.4 IMCO United Nations Numerical Health Vapor Irritant Liquid or Solid Irraant 13 10 Vapor (Gas) Specific Gravity: 3.4 Poisons 13 11 Ratio of Specific Heats of Vapor (Gas): Water Pollution Not perforent Human Loxicity 13 12 Latent Heat of Vaporizatio Aquatic Toxicity Vesthetic Effect 5. HEALTH HAZARDS 10 10 Bulb = 7 3 = 30 34 × 10 1 4g Personal Protective Equipment: Protective pageles whose Reactions me Following Exposure: 15H M ATION or uses trut atom of upper responders trust 13 13 Heat of Combustion: - (x 120 Big. lb. Other Chemicals THAT WILLS A STREET THAT THE ACT OF THE ACT \* 10-400 cal p = 435.4 × 107.3 kp Water Seff-Reaction 13.14 Heat of Decomposition: Not pertinent 12.3 NFPA Hazard Classificat 13.15 Heat of Solution: Not pertinent Calegory 13.16 Heat of Polymerization: N a pertinent Health Hazard (Blue) Hammability (Red) Reactivity (Yellow) to the INHM AHON monotone especiation give to do not also never seen INOESTION do to the commence in meeted ground against the new control NEIN wipe off and wash 5. HEALTH HAZARD (Cont'd.) Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory ed Limit Value) (No. 1976, LLV applicable system if present in high concentrations. 13 - effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. It spilled on stathing and allowed. to remain, may cause smarting and reddening of the skip 5 10 Odor Threshold: 0.25 ppm

#### GASOLINE BLENDING STOCKS: REFORMATES

Common Syno	Watery liquid	Colorless Gasoline odor		6. FIRE HAZARDS Flash Point: (a) <0   1	8. WATER POLLUTION  8.1 Aquatic Toxicity: 90 ppm 24 for resemble Ansers in find 11 in fresh water 91 ppm 24 for sende Ansers in shad
Shut off ig Stay upwir	arge if possible. Keep people away nition sources and call fire depar- du and use water spray to "knock remove discharged material. al health and pollution control age	nent down" vapor.	6 3	(a) 1 P. 8 ° .  Fire Extinguishing Agenta: Dry chemical foamsarthun diviside  Fire Extinguishing Agents Not to be Used: Water may be methodise.  Special Hazards of Combustion Products: None.	8 2 Waterfowl Toxicity: Data not available 8 3 Biological Oxygen Demand (BOD): 8 1 Note: 8 4 Food Chair Concentration Potential: Note:
Fire	FLAMMABLE, Flashback along vapor trail me Vapor may explode if ignited Extinguish with dry chemical Water may be ineffective on Cool exposed containers with	in an enclosed area. , foam or carbon dioxide. ire.	67	Behavior in Fire: Vapor is heavier than air and may travel a considerable do ince to a source of ignition and the behavior.  Justino Temperature: Data not available Electrical Hazard: Class Egroup D.  Surning Rate: 4 min. min.	9. SELECTED MANUFACTURERS  1. Excon Co. 30 Rocketchia Plaza New York N. Y. 19920  2. Shell Oil Co. E-Shell Plaza Houston Texas 77001
Exposure	Remove contaminated clothin	headache, difficult iousness. artificial respiration. xygen. or vomiting. g and shoes.	7 2 7 3 7 4 7 5	7. CHEMICAL REACTIVITY Reactivity with Water: Not section Reactivity with Common Materials: Not section Stability During Transport: Stability During Transport Stability During Tr	V. Nar Oli Co. Nr. Davids, Pr. 19087
Water Pollution	Plush affected areas with plen IF IN EYES, hold eyelids ope IF SWALLOWED and victim or mith DO NOT INDUCE VOMITING	iy of water.  and flush with plenty of water.  s CONSCIOUS, have victim drink water  G.  FE IN VERY LOW CONCENTRATIONS.  ater intakes.  te officials.		Inhibitor of Polymerization: Not pertunent	10. SHIPPING INFORMATION 10.1 Grades or Purity: Composition sames with range of distillation temperatures used 10.2 Storage Temperature: Authoria 10.3 Inert Atmosphere: No requirement 10.4 Venting: Open change arresters or pressures account
:See Response		2 LABEL		11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook EQ 446-5). A-T-(U-V-W	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: Not pertinent 13.3 Boiling Point at 1 atm: 58 (275.1) = 14 (15 C = 287.400 K) 13.4 Freezing Point: Not pertinent
3 1 Synonyme: N 3 2 Coast Guard Miscellane 3 3 Chemical Fo 3.4 IMCO/United	DICAL DESIGNATIONS NO common sensions Compatibility Classification: rous hydrocarbon mixtures wrmula: Not pertinent d Nations Numerical 3.1.1.2/1201	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): I iguid 4.2 Color: Colorless 4.3 Odor: Gasoling	1 1	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Liammable liquid NAS Hazard Rating for Bulk Water  Transportation: Category Rating Inc Health Vapor Irritant Liquid or boild Irritant Possans Q Water Pollution Human Loxioty I	13.5 Critical Temperature: Not pertinent 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 0.7934 at 20°C (liquid) 13.8 Liquid Surface Tension: 19 23 dynes can = 0.019 0.023 N m at 20°C 13.9 Liquid-Water Interfacial Tension: 49 Nidanes cm = 0.039 0.031 N m at 20°C 13.10 Vapor (Gas) Specific Gravity: 3.4 13.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent 13.12 Latent Heat of Vaporization:
5.2 Symptoms Financial ner dizziness, I heartheat the garging, di hronchopni depression stomach s. 5.3 Treetment fo	elective Equipment: Protective gollowing Exposure: ISHALAT is reasonable to the standard protection of the seasonable and incoordination to an stangerous complication. ASPIR syspens: substernal distress, and tag techniques and prejuments, acute to ISGESTION causes ritiation of standard inclined by depression of Exposures. Seek medical attention of Exposures. Seek medical attention of the Exposures.	H HAZAROS  Inggles, gloves  (ION causes ritiation of upper respirators tract, or depression of sarsing degrees ranging from eithesia, coma, and respirators arrest, irregular A HOV causes secret long ritiation with coupling, undis developing patinonars defend, later, signs of meet of central nervous system followed by timecons membranes of throat, ecophagus, and of central nervous systems, irregular heartbeat on ISHA A HOV maintain respiration, give direct, administer oxygen 1804 S HOV, do	12 3	Aquatic Toxicity 2 Aesthetic Effect 2 Reactions Other Chemicals 0 Water 0 Set Reaction 0 NFPA Heazard Classifications: Category Classification Flexible Hazard (Blue) Flammability (Red) 3 Reactivity (Yellow) 0	130 - 180 No. 16 = 71 - \$1 call y = 3.0 - \$4 × 10.7 kg = 3.0 - \$4 × 10.7 kg    13.13 Heat of Combustion: −18,72° B(a) is = -10,400 call y = −43.5 4 × 10.7 kg    13.14 Heat of Decomposition: Not perture it is 13.15 Heat of Solution: Not perture it 13.15 Heat of Polymerization: Not perture it 13.16 Heat of Polymerization: Not perture it is 13.15 Heat of Polymerization it is 13.15 Heat of Polyme
aspiration with soap. 5.4 Texicity by fr 5.5 Short-Term 5.6 Texicity by fr 5.7 Late Texicity 5.8 Yepor (Gee)	into lungs. EYES, wash with copic and water inhalation (Threshold Limit Valua inhalation Limits: 500 ppm for 9 ingestion: Grade 2.1 Dw0 5 to 5 g p. None.	Emin  Tkg  Cause a slight smarting of the eyes or respirators	1 1	HEALTH HA  Liquid or Solid Irritant Cherocloristics: Min to remain, max cause smarting and reddenin  Odor Threshold: 0.25 ppm	

## GASOLINES: CASINGHEAD

Stop dische Stat off ign Stay upmin leolet and Notify local	Watery liquid	Colorless Gasoline odor immable, irritating vapor is  r, ment. down" vapor. encies.	62 63 64 65	6. FIRE HAZAROS Flash Point: <0°F O C Flammable Limits in Air: 13° 7°F. Fire Extinguishing Agents: Dry chemical, foam, or carban droude Fire Extinguishing Agents Not to be Used: Water may be inellective Special Hazarde of Combustion Products: None Behavior in Fire: Vapor is heavier than air and may travel a considerable	8. WATER POLLUTION 8.1 Aquatic Toxicity: 90 ppm;/4 hr juvenile American shad 11 m;/fresh water 91 ppm;24 hr juvenile American shad 11 m;/ast water 8.2 Waterfood Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 8%, 5 days 8.4 Food Chain Concentration Potential: None
Fire	FLAMMABLE. Plashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extringuish with dry chemical, foam or carbon dioxide. Water may be ineffective on five. Cool exposed containers with water.		68	arrand may trace a consociation and distance to a course of spirition and flash back.  Ignition Temperature: Data not available  Electrical Hazard: Class I, group D  Burning Rate: 4 mm. min	9. SELECTED MANUFACTURERS  1. Exxon Co. 30 Rockefeller Plaza New York, N. Y. 10020  2. Sheff Orl Co. 1. Sheff Plaza Houston, Texas 27001
Exposure	CALL FOR MEDICAL AID.  VAPOR Irritating to eyes, nose and throat. If inhalted uses dizziness, headache, difficult breathing or low for one of the control of		72 73 74 75	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stabilic Neutralizing Agents for Acide and Caustics: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent	10. SHIPPING INFORMATION  10. SHIPPING INFORMATION  10.1 Grades or Purity: Composition depends on location of oil well  10.2 Storage Temperature: Ambient  10.3 Inert Atmosphere: No requirement  10.4 Venting: Open (hame arrester) or pressure-vacuum
-See Response A	Fouling to shoretine. May be dangerous if it enters to Notify local health and wildl Notify operators of nearby to NSE TO DISCHARGE Memodos Mandeood CG 446-41 to the publishment and the state of the s	life officials.		11. HAZARD ASSESSMENT CODE  (See HAZA'C Assessment Handbook CG 446-3)  A-T-U-V-W	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Engad 13.2 Molecular Weight: Not pertinent 13.3 Boiling Point at 1 atm: 15.275   = 14 - 135°C = 287 - 405 K. 13.4 Freezing Point: Not pertinent
3 1 Synonyme: N 3 2 Coest Guard ( Miscell 3 3 Chemical For	Compatibility Classification: laneous hydrocarbon mixtures mula: Not pertinent I Nationa Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): 1 iquid 4.2 Color: Colorless 4.3 Odor: Cassaine		12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water  Transportation:  Category Rating  Fire 4  Health  Vapor Irritant I  Liquid or Solid Irritant 0  Puisons I  Water Pollotion  Human Toxicis I	13.5 Critical Temperature: Not pertinent 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 0.671 at 15*C (liquid) 13.8 Liquid Surface Tension: 19*2 21 dancs on = 0.019*0.022 N mar 20*C 13.9 Liquid-Water Interfacial Tension: 40*N 1 dancs on = 0.049*0.018 N mar at 20*C 13.10 Vapor (Gas) Specific Gravity: 3.4 13.11 Ratio of Specific Heats of Vapor (Gas): Not the control of the control
5.2 Symptoms For central ners dizziness hi irregular hi with cought ofernal late vision excu- mentiums central ners	ective Equipment: Protective gibliowing Exposurer: INTAL AT onessivatem stimulation followed breads he, and mecondination to an earthest is dangerous complication in une gagging dispined substemate regions of bronchipmeumenta and terment followed by depression. In ordinary of those compliages and stimulations of those respirages and stimulations is the articular heartheat.	ION causes arritation of upper respiratory fract, by depression of surving degrees ranging from resibesta, comit, and respiratory arrest, in ASPIRATION causes severe lung irritation distress, and rapids developing puttinonary of pneumonities, acute onset of central nervous GCESTION causes irritation of macross this simulation followed by depression of	12 3	Aquata Toward 2 Acethetic I ffect 1 Reactivity 1 Other Chemicals 0 Water 0 Self-Reaction 0 NFPA Hazard Classifications: Catagory Classification Health Hazard (Blue) 1 Flammabhity (Red) 3 Reactivity (Yellow) 0	180   180   Bit in h = 71   A1 cal. y = 30   14   A2   Bit   Bit    13   13   Head of Combustion: - 18   70   Bit in h = -10 400 cal. y = -445   4 × 10° 3   kg    13   14   Head of Decomposition: Not pertinent    13   15   Head of Solution: Not pertinent    13   16   Head of Polymerization: Not pertinent
give oxygen do NOT on igamit aspi	n il needed ASPIRATION enfor duce vomiting lavage carefully it a	non INHALATION maintain respiration, rec'hed rest administer ovygen INGENTION appreciable quantity was ingested, guard ith copious quantity of water SKIN wipe off		5. HEALTH HA	(Continued on pages 5 and 6
5.4 Foxicity by Inf	halation (Threshold Limit Value		5 8	Vapor (Ges) Irritant Characteristics: Vapors system if present in high concentrations. The	
	<b>chalation Limits:</b> 500 ppm for 30 <b>gention:</b> Criside 2. L D <sub>0</sub> -0 5 to 5 g		5 9	Liquid or Solid Irritant Characteristics: Min- to remain, may cause smarting and reddening	iumum hazard. If spilled on clothing and allowed

### GASOLINES: POLYMER

Watery liquid Floats on water. Flammable, irritating vapor is produced. Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies. FLANMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water. Fire CALL FOR MEDICAL AJD VAPUM
Initiating to eyes, nose and throat.
If inhaled, will cause dixtiness, headaches, difficult breathing
or loss of consciousness.
Move to fresh air.
If breathing has topoped, give artificial respiration.
If breathing is difficult, give oxygen. LIQUID LIQUID
Initiating to skin and eyes.
If swallowed, will cause nausea or vomiting,
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN FYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water. Exposure or milk. DO NOT INDUCE VOMITING. Notify local health and wildlife officials. Notify operators of nearby water intakes 1. RESPONSE TO DISCHARGE 2. LABEL Issue warning high flammability Evacuate area Disperse and flush 3. CHEMICAL DESIGNATIONS 4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): 1 iquid 3 2 Coast Guard Compatibility Classificat 4.2 Color: Colorless Miscellaneous hydrocarbon mixtures Chemical Formula: Not pertinent 3.4 IMCO/United Nations Numerical Designation: 3 2/1215 5. HEALTH HAZARDS nt: Protective gaggles, gloves 5.2 Symptoms Following Exposure: INHALATION causes irritation of upper respiratory tract, central nervous system stimulation followed by depression of varying degrees ranging from dizziness, headach, and incoordination to anesthese, coma, and respiratory arrest irrigular heartheat is dangerous complication. ASPIRATION causes severe lung tritation with coupling, pagging, dyspica, substernal distress, and rapidly developing pulmonars edema, later, (gives of bronchipperumonia and pneumonities, caute unset of central nervous system excitement followed by depression INGESTION causes irritation of mucous membranes of throat expobation, and stomach stronglatory followed by depression of the coupling of the coupling of the company of the coupling of t throat, esophagus, and stomach, stimulation followed by decression of central nervous system 5.3 Treetment for Exposure: Seek medical attention INHALATION, maintain respiration. oxygen if needed. ASPIRATION enforce bed rest, administer oxygen Inceded, ASPIRATION enforce bed rest, administer oxygen INGESTION do NOT induce vomiting, lavage carefully if appreciable quantity was ingested, guard against aspiration into lungs. EYFS: wash with copious quantity of water. SKIN wipe off and wash with soup and water 5.4 Toxicity by Inhalotton (Throshold Limit Value): No single TLV applicable 5.5 Short-Term Inhalation Limits: 500 ppm for 30 min. 5.8 Testally by Ingustion: Grade 2; LDu 0.5 to 5 g/kg By: None

6. FIRE HAZARDS 6.1 Flesh Point: 0.71/1 C.C. 6.2 Flammable Limits in Air: 1.75 - 77.7 C.C. 6.3 Fire Extinguishing Agents: Dry chemical foam carbin dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water may be meltective 6.5 Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products: Note of the Product of Special Hazards of Combustion Products of Special Hazards of Combustion P	8. WATER POLLUTION 8.1 Aquatic Toatelty: 90 ppm 24 hr invente. Ancrean shad 11 in fresh water 91 ppm 24 hr invente. Ancrean shad 11 in salt water 8.2 Waterfourt Toatelty: Data not available 8.3 Biological Oxygen Demend (BOD): 8% Stars 8.4 Food Chain Concentration Potential: Note  9. SELECTED MANUFACTURERS 1. Favon to 90 Roscheller Plaza Now you. N. Y. (1920) 2. Shell Child. 1. Shell Plaza Houston: Feas (2001) 3. Sun Child. 4. Sun Child. 5. Darks. Pa. 1900.
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Causalics: Not pertinent 7.5 Polymerization: Not pertinent 7.6 Inhibitor of Polymerization: Not pertinent	10. SHIPPING INFORMATION  10.1 Grades or Purity: Composition varies with range of distillation temperatures used Contains mostly soldier, and the subsequence is such as the contains and inert atmosphere: No requirement 10.4 Venting: Open flame arrester or pressure vacuum
11. HAZARD ASSESSMENT CODE  15-re riazard Assessment Introduce. CG 446 31  A-T-U-V-W  12. HAZARD CLASSIFICATIONS  12.1 Code of Federal Regulations: Flammable Injurid  12.2 NAS Mazard Rating for Bulk Water Transportation:  Category Rating  I re 1  Health Vapor Irritant 1 signed or Solid Irritant 1 signed or Solid Irritant 1 signed or Solid Irritant 1	13. Physical AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 etm: 1 grad 13.2 Molecular Weight: Not performed 13.3 Boiling Point at 1 atm: 10.2 Feb. 13.4 Freezing Point: Note: 10.4 Freezing Point: 10.4 Freezin

por (Gao) britant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary

Water Pollution Human Toxicity
Aquatic Toxicity
Aesthetic I ffect Water Self-Reaction 12.3 NFPA Hazard Class

Category Flammability (Red) Reactivity (Yellow)

- 13 11 Ratio of Specific Hosts of Vapor (Gos)
- 140 150 No. 16 5 + 30 14 + 4 1 4 4
- 13 14. Heat of Decomposition:  $\infty$
- 13.15 Heat of Solution: Name of the control 13 16 Heat of Palymerization 💉 🦠

#### 5. HEALTH HAZARDS (Cont'd.)

5.9 Liquid or Solid Irritant Characte for Minimum hazard. If spilled in clothing and allowed to remain, may cause smarting and reddening of the skin

5.10 Odor Threshold: 0.25 nem

## GASOLINES: STRAIGHT RUN

_					
Common Synon	Watery tiquid	Colories Gasoline odor	61	6. FIRE MAZAROS Flack Point:	8. WATER POLLUTION 8.1 Aquatic Texicity: 90 ppm 24 hr. juvenile American shad
	FLAMMABLE	Flammable, irritating vapor is produced.	63 64 65	the 0.34.1.C.C. Flammable Limits in Air: (a) 1.10, 7.10. Fire Extinguishing Agents: Dis- schemical loam carbon disoid. Fire Extinguishing Agents Not to be Used: Water mas be ineffective. Special Hezards of Combustion Products: None.	90 ppm 24 nr josenic Anterican shad II m /Irch water 91 ppm 24 hr jusenic American shad II m salt water 82 Waterfowl Tasichly: Data not available 83 Biological Oxygon Domand (80D): 8' > 3dass 84 Food Chein Concentration Potential: Some
	Plashback along vapor trail Vapor may explode if ignit	I may occur aed in an enclosed area.	67	Behavior in Fire: V apor o heavier than on and may travel a considerable distance that source of ignition and flash back [gottlen Temperature: Data not available Electrical Hazard: Class Leroup D Burning Rate: 4 mm min	9. SELECTED MANUFACTURERS  1. Exon Co. 30 Rox Acefeller Plaza New York, N. Y. (10020)  2. Shell Oil Co. 1. Shell Plaza Houston Texas 77001
Exposure	VAPOR Irritating to eyes, nose and If inhaled, will cause dizzir breathing or loss of co	ness, headache, dùfficult onsciousness.	72 73 74	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not per	3 Sun Oil Co St. Davids, Pa. 19087
Water Pollution	HARMFUL TO AQUATIC Fouling to shoreline. May be dangerous if it ente	LIFE IN VERY LOW CONCENTRATIONS. Pres water intakes.		Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent	10. SHIPPING INFORMATION  10.1 Grades or Purity: Composition surce with range of distillation temperatures used  10.2 Storage Temporature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Verifing: Open (flame arresters or pressure-sacuum
1. RESPONSE	E TO DISCHARGE oos Nandsook CG 446 41 high flummubility	2. LABEL FLAMMABLE LINUM	<b>   -</b>	11. HAZARD ASSESSMENT CODE  (See Hazard Assessment Mandbook CG 446-3)  A. TL. AW.	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Usuad 13.2 Molecular Weight: Not pertinon 13.3 Boiling Point at 1 atm: 55 275 6 14. (35°C = 28° 306 K)
3.1 Synonyma: Noci 3.2 Coast Guard Cor	mpatibility Classification: aneous hydrocarbon mixtures ils: Not perfinent itions Numerical	A. OBSERVABLE CHARACTERISTICS     1 Physical State (as shipped): Ergoid     2 Color: Cubrics     4.3 Odor: Guseline		12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hezard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Fretant   Figure of Solid Fretant   Flammable of Solid Fretant   Persons 2 Marie Refuterion	13.4 Freezing Point: Not pertinent 13.5 Critical Tensperature: Not pertinent 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 0.71 0.74 0.74 0.44 0.00 13.8 Liquid Surface Tension: 19 23 dancs cm = 0.019 0.028 mar.20 0.00 13.9 Liquid-Water Interfacial Tension: 49 51 dancs cm = 0.049 0.081 N m ar.2010 0.00 13.10 Vappe (Gas) Specific Gravity: 3.4 13.11 Ratio of Specific Heats of Vapor (Gas):
5.2 Symptoms Folion central nersous dizzness head heartbeat is dail coughing, gagg later, signs of heast rement foll throat, exophal system, irregul	dve Equipment: Protective e- wing Exposure: INFALATI vs stem stimulation followed b- asche, and invocidination to a niverous complication. ASPIR use, disspired, substemal distre- tron-hopicuminia and pieum- towed by depression. INGESTI gus and stomach, stimulation far heartheat.	ION causes irritation of upper respiratory tract, by depression of sarving degrees tanging from testhesia come, and respiratory arrest, irregular (ATION) causes severe lung irritation with country and testhesia come, and rapidly developing pulmonary edema, onities, acute onset of central nervous system ION causes irritation of mucous membranes of followed by depression of central nervous	12 3	Water Pollution Human Lovicits 1 Augusts Lovicits 2 Aesthetis Ellics Other Chemicals Other Chemicals Other D Self Reaction ONFPA Hazard Classifications: Catogory Classification Health Hazard (Blue) Flammabilits (Red) Flammabilits (Red) Flammabilits (Ped) Other Committee Commi	Not perturent  13 12 Latent Heart of Vaporization:  130 130 Ru Uh = 71 N Lat (e = 10 N Lat (r) 130 N Lat (r) 14 N Lat (r) 14 N Lat (r) 14 N Lat (r) 15 N Lat (r)
oxygen if neede NOF induce yo aypiration into with soap and y	ed ASPIRATION enforce be omiting, lavage carefully if app- lungs. EYES, wash with copio water.	ion INFAS AFRO: maintain repration, give ed rest, administer oxygen INGFION do recruble quantity was ingested, guard against just quantity of water SKIN wipe off and wash	-	,	IC attraved on pages 5 and 6.  AZARDS (Cont'd.)
5.5 Short-Tarm Inhal	otion (Threshold Limit Value lation Limits: 500 ppm for 30 Mone: Grade 2, L D <sub>0</sub> 0 5 to 5 g, one	D min		Vapor (Gas) Irritant Characteristics: Vapor system (present in high concentrations. The Liquid or Solid Irritant Characteristics: Min to remain, may cause smarting and reddening Odor Threshold: 0.25 ppm.	s cause a slight smarting of the eves or respiratory effect is temporary nimum hazard. If spilled on clothing and allowed

#### **HYDRAZINE**

8. WATER POLLUTION 6. FIRE HAZARDS 8.1 Aquatic Toxicity: 136 ppm///2 5 hr rainbow frout died-Flash Point: 100°1 O C 6.2 Flammable Limits in Air: Mixes with water. Poisonous, flammable vapor in produced. Freezing point is 35° F. 4.7° 100°. 8.2 Waterlowi Toxicity: Data not available 6.3 Fire Extinguishing Agents: Water alcohol foam carbon drovide or dry chemical AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away. Wear chemical protective suit with self-contained breathing apparatus. Stop discharge if possible. Call file department as Stay upwind and use water spary to "knock down" vapor. Isolate and remove discharged materials. Notify local health and pollution control agencies. 8 3 Biological Oxygen Demand (BOD): Fire Extinguishing Agents Not to be Used: Not pertinent None Special Hazards of Combustion Products: Lovic vapor is generated when heated FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
War chemical protective suit with self-contained breathing apparatus.
Combat first from safe distance or protected location.
Flood discharge area with water.
Extinguish with dry chemical, alcohol foam, or carbon dioxide.
Cool exposed containers with water.
Continue cooling after fire has been extinguished. Behavior in Fire: May explode it contined Ignition Temperature: 9. SELECTED MANUFACTURERS Fairmount Chemical Co., Inc. 147 Blanchard St. Fire Electrical Hazard: Not pertinent Newark N J 07105 6.9 Burning Rate: Lymn gon cast c Ohn Corp Chama de Daviston CALL FOR MEDICAL AID. Stamford, Conn. 06904 7. CHEMICAL REACTIVITY VAPOR POISONOUS IF INHALED OR IF SKIN IS EXPOSED. Unitoval Chemical Division Reactivity with Water: No reaction Move to fresh sir.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen. spencer St 7.2 Reactivity with Common Materials: augatuck, Conn. 06270 Can each the when in contact with porous materials such as wood LIQUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED. shestos, cloth, earth and rusts POISONOUS IF SWALLOWED OR IF SAIN IS EXPUSED.
Will burn eye.
Remove contaminated clothing and shoes.
Plush affected areas with plenty of water.
IF IN EYES, hold cyclids open and flush with plenty of water.
IF IN EYES, hold cyclids open and flush with plenty of water.
IF SWALLOWED and within a COMSCOUS, have victim drink water. 7.3 Stability During Transport: Stable Exposure at ordinary temperatures. When heated can decompose to introgen 10. SHIPPING INFORMATION and ammonia gases, but decomposition Grades or Purity: Anhydrous 15 - 64% water solutions or milk.
DO NOT INDUCE VOMITING. not hazardous unless material is Storage Temperature: Neutralizing Agents for Acids and Caustics: Flush with water Ambien1 Neutralize the resulting solution with calcium hypochlorite (HTH) (\*1bs per thos) hydrazine) 10.3 Inert Atmosphere: Padded 10.4 Venting: Pressure-vacuum HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes.

Notify local health and widdlife officials.

Notify operators of nearby water intakes. Water 7.5 Polymerization: Not pertinent **Pollution** 7 6 Inhibitor of Polymerization: 1. RESPONSE TO DISCHARGE 2. LABELS 11. HAZARD ASSESSMENT CODE 13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: 1 iguid See Hazard Assessment Hangbook CG 446-3 Issue warning high flammability. 13.2 Molecular Weight: 32.05 A-P-O corrosive 13.3 Soiling Point at 1 atm: 236.35F = 113.55C = 3x6.75K Restrict access
Chemical and physical treatment 13.4 Freezing Point: 34.715 = 3.510 = 2.411 K 12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable Liquid 13.5 Critical Temperature: 3. CHEMICAL DESIGNATIONS 4. OBSERVABLE CHARACTERISTICS 716 F = 380 C = 653 A 3.1 Synonyme: No common synonyme 4.1 Physical State (as shipped): Liquid NAS Hazard Rating for Bulk Water 13.6 Critical Pressure: 3 2 Coast Guard Compatibility Clar 4.2 Color: Colorless Not applicable 4.3 Odor: Ammonia-like 13.7 Specific Gravity: | (ibs at 20 C shaunft Category 3.3 Chemical Formula: N.H. 13.8 Liquid Surface Tension: Not pertinent 3.4 IMCO United Nations Num Designation: 8.0-2030 13.9 Liquid-Water Interfacial Tension: Vapor frestant Liquid or Solid Irritant Poisons 13.10 Vapor (Gas) Specific Gravity: 13 11 Ratio of Specific Heats of Vapor (Gas): Water Polluture 5. HEALTH HAZAROS 13 12 Latent Heat of Vaporization Aestheric Effect reanal Protective Equipment: Ammonia-type gas mask, self-contained breathing plastic-coated or rubber gloses, clothes, and apron, safety shower must be available mt: Ammonia-type gas mask, self-contained breathing apparatus. = 299 cat g = 12 5 × 1011 kg 13 13 Heat of Combustion: -5345 Big th = -4636 cut g = -194 f × 1011 kg Reactivity Symptoms Following Exposure: Vapors cause tiching, swelling, and blistering of eyelids, skin, nine and throat, simptoms may be delayed for several hours. Temporary blindness may occur. Liquid causes a caustic-like burn if not washed off at once. Ingestion or absorption through skin causes nausea, disziness, headache Severe exposure may cause death. Other Chemicals 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: -21x Bio Ib = -12t cal g = -5.07 × 1013 kg 123 NFPA Hazard Cla defining the Exposurer Call adoctor at once INHALATION: remove to fresh air, observe for declayed symptoms. Keep quiet INGESTION do NOT induce comiting, give egg whites or other emothent. SKIN OR EYES, wash with large amounts of water for all Category 13.16 Heet of Polymerization: Not pertinent Houlth Hazard (Blue) Flammability (Red) Reactivity (Yellow) 5.4 Texicity by Inhalation (Threshold Limit Value): 1 ppm Considered on pages 1 and 6 5.5 Short-Term Inhelation Limits: 1 ppm for 30 mm. 5.6 Toxicity by ingestion: Grade 3: LDu 50 to 500 mg/kg (rat) NOTES Late Texicity: Causes lung cancer in mice. Vapor (Bas) hylland Characteristics: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations Liquid or Solid irritant Characteriolists: Severe skin irritant, Causes second- and third-degree rns on short contact; very injurious to the eyes 5.10 Oder Threshold: 3 - 4 ppm

HDQ

# **HYDROQUINONE**

		- · · · · · · · · · · · · · · · · · · ·	_		•		
Shut off ignitic Stop dichary, Isolate and ren Notify local he	I6 hexameaded p-Daby devaybenases Hydroquinal Programatic acids Guined  Sinks and mixes with water.  Sinks and mixes with water.  Avoid contact with solid and dust. Keep people away. Shut off ignition sources. Call fire department. Stop dischap. if pomble. Isolate and remove discharged material. Notify local health and pollution control agencies.  Combustible			6. FIRE HAZARDS Flack Point: (molten) 350°F O C Flammable Limits in Air: Not pertinent Fire Extinguishing Agents: Water, foam, dry.hemical, carbon dioxide Fire Extinguishing Agents Not to be Used: Special Hazards of Combustion Products: Behavior in Fire: Dust explosion is possible lanition Temporobure: Date not available	8. WATER POLLUTION 8.1 Aquatic Teaticity: 0 287 ppm/48 hr/goldfish/Ti.m/fresh water 8.2 Waterleut Teaticity: Data not available 8.3 Biological Oxygen Demand (BOD): 53%, 5 days 25% (theo), 0 5 days, as catechol 8.4 Food Chain Concentration Potential: None		
Dust	Dust cloud may explode if ignited in an enclosed area.  Extinguish with water, dry chemicals, foam, or carbon dioxide.			Electrical Hazard: Data not available  Electrical Hazard: Data not available  Burning Refe: Not pertinent	9. SELECTED MANUFACTURERS  1. Eastman Chemical Products, Inc Kingsport, Tenn 37662  2. Allied Chemical Corp Specialty Chemicals Dis P. O. Bos. 1087R Morristown, N. J. 07960		
Exposure  Exposu	consciousness.  Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EVES, hold eyelids open and flush with plenty of water. IF IN EVES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce romiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.  Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local beath and wildlife officials.			7. CHEMICAL REACTIVITY Reactivity with Weber: No reaction Reactivity with Common Materiale: Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent	3. Aldrich Chemical Co 940 W. Saint Paul Ave Milwaukee, Wis 53233  10. SHIPPING INFORMATION 10.1 Grades or Purthy: Pure: Technical 10.2 Storage Temperature: Ambient 10.3 Inert Atmosphere: No requirement 10.4 Venting: Open		
RESPONSE TO I     (See Response Methods Hand     Issue warning water     Disperse and flush	dbook. CG 446-4)	LABELS  No hazard label required by Code of Federal Regulations		13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Solid 13.2 Molecular Weight: 110 11 13.3 Bolling Point at 1 atm:			
3.1 Symonyme: 1,4-Benzen p-Dhivdroxybenzene. Pyrogentise acid, Qu 3.2 Coest Guard Compatit Not fisted 3.3 Chomical Permula: 1,4 3.4 ISECO/United Molione	3.3 Chemical Fermula: 1.4-C <sub>4</sub> H <sub>4</sub> (OH) <sub>2</sub>			12. MAZARD CLASSIFICATIONS Code of Federal Regulations: Not listed NAS NAZARD Reting for Bulk Weter Transportation: Not listed NFPA Hazard Clessifications: Not listed	545°F = 285°C = 558°K  13.4 Freezing Point: 338°F = 170°C = 443°K  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 133 at 20°C (solid)  13.8 Liquid Surface Tension: Not perturent  13.9 Liquid Surface Tension: Not perturent  13.10 Vaper (Gae) Specific Gravity: Not pertirent  13.11 Ratio of Specific Heats of Vaper (Gae): Not perturent		
5.2 Symptome Pellouring II of sufficiation, increa dyspnea, cyanous, de is 2 grams Direct cot irritation and may re 5.3 Trestment for Exposur saline catheric and d water for 15 min. and	subpresset: Goggles, res Exposures: Ingestion ca sed respiration rate, vor elirium, and collapse; the ntamination of the eye we sult it ulceration of the res: INGESTION: indu lemukents, get medical of get medical attention	A HAZARDS  spiratory protection if dust is present in cause ringing in the ears, nausea, dizziness, a sense miting, pallor, muscular twitchings, headache, e urine is green or brownish-green. Lethal adult dose with particles of hydroquinone can cause immediate cornea. Contact with skin may cause dermatitis. ev vomitings, perform gastric lavage, and follow with a attention. EV ES. Bush immediately with plenty of SKIN wash with soap and water.			13.12 Letent Heat of Vaporization: Not pertinent  13.13 Heat of Combustion: —11.200 Btu/lb  = -6.220 cal/g = -260 × 10° J/kg  13.14 Heat of Decomposition: Not pertinent  13.15 Heat of Solution: Not pertinent  13.16 Heat of Polymerization: Not pertinent		
5.5 Short-Term inhalation 5.6 Toxisity by Ingestion:	Limitis: Data not avai Grade 3, f.D <sub>50</sub> 370 mg/ hladder cancer in mice, haracteristics: Data n t Characteristics: Data	lable (kg trat) discoloration of eyelids and eye changes in men iot available	-	N.	(Continued on pages 3 and 6)		

# JET FUELS: JP-4

Comman Synony	Common Synonyms Watery liquid			Colorless	Fuel oil ador	
		Floats on water				
Stop discharge if possible. Keep people away. Shut of ignition sources and call fire department Avoid contact with liquid god material. Isolate and remove discharge material. Notify tocal health and pollution control agencies.						
Fire	FLAMMABLE  Extinguish with dry chemical, fourn, or carbon dioxide, Water may be ineffective on fire. Coul exposed containers with water.  Fire					
Exposure	CALL FOR MEDICAL AID. LIQUID Irritating to skin and eyes. Harmful if wallowed Remove contaminated clothing and shoes. Flush affected verse with plenty of water. IF IN EYES, hold eyelids upen and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.					
Water Pollution	May be dangerous if it enters water intakes.					
1. RESPON	SE TO D	ISCHARGE		2. LASEL		
iSee Response Me Issue warning Mechanical or Should be ren Chemical and	high Na ontainmer ioved	mmability II				
3. CHEMICAL DESIGNATIONS 3.1 Synonyme: No common 5, notyms 3.2 Coest Querd Competibility Cleestfication: Miscellaneous hydrocarbon mixtures 3.3 Chemical Formula: C <sub>n</sub> H <sub>m+1</sub> 3.4 IMCO/United Nettens Numerical Designation: 3.2/1x63		41 42 43	Physical State (a Golor: Colorless	-		
5. HEALTH HAZARDS						
5.1 Personal Protective Equipment: Protective gloses, goggles or face shield 5.2 Symptoms Pollowing Exposures: Vapor causes slight irritation of eyes and nose. Equid irritates stomach, if Taken into lungs, causes coughing, distress, and rapidly developing pulmonary edem.						
INGESTIO	N do NO	t ASPIRATION enfo T induce vomiting, call isoap and water			ygen, call a doctor a plenty of water SKIN	
		Threshold Limit Value				
		Limite: 2500 mg/m <sup>3</sup> f		min.		
56 Texicity by ing 57 Late Texicity:		irade 2-1 Dn 0 5 to 5 g available	/ <b>k g</b>			
5.8 Vapor (Gas) in	Hant Ch	eractoriolica: Vapors			he eyes or respiratory	
Vapor (Qoo) Inthem Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.  S    Liquid or Solid Inthem Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.  S    10 Odor Threeholds:   ppm.						

	6. FIRE HAZARDS	8. WATER POLLUTION
6.1	Flash Point: =10° f to +30° f C C	B 1 Aquatic Texicity:
6.2	Flammable Limits in Air:	500 ppm/* salmon biggerling lethal fresh water
	1.43 × 80%	*Lime period not specified
63	Fire Extinguishing Agents: Foam, dry	8.2 Waterlowi Toxicity:
١	chemical, or carbon dioxide	Data not available
6 4	Fire Extinguishing Agents Not to be Used:  Not pertinent	8.3 Siological Oxygen Demand (SOD):
65	Special Hazards of Combustion Products:	Str. Sdave
0.5	Not pertinent	8 4 Food Chain Concentration Potential:
66	Behavior in Fire: Not pertinent	None
67	Ignition Temperature: 464°1	
	= -	
6.8	Electrical Hazard: Not pertinent	9. SELECTED MANUFACTURERS
69	Burning Rate: 4 mm, mm	1 Asserta
		30 Rocketeller Plaza
ì		New York, N. Y. 10020
		2 Shell Oil Co
		I Shell Plaza
		Houston, Lex 77001
		₹ Sun Oil Co
	7. CHEMICAL REACTIVITY	240 Radnor Rd
7 1	Reactivity with Water: No reaction	St. Davids, Pa. (90k*
7.2	Reactivity with Common Materials:	
l	No reaction	
73	Stability During Transport: Stable	
7.4	Neutralizing Agents for Acids and	
	Caustics: Not pertinent	
7.5	Polymerization: Not pertinent	
76	Inhibitor of Polymerization:	10. SHIPPING INFORMATION
	Not pertinent	10.1 Grades or Purity: 100%
		10.2 Storage Temperature: Amhient
		10.3 Inert Atmosphere: No requirement
		10.4 Venting: Open (flame arrester) or
		pressure-vacuum
		pressure-vacuum
	11. HAZARD ASSESSMENT CODE	13. PHYSICAL AND CHEMICAL PROPERTIES
	11. HAZARD ASSESSMENT CODE ISee Hazard Assessment Handbook CG 446-3)	pressure-vacuum
		13. PHYSICAL AND CHEMICAL PROPERTIES
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State of 15°C and 1 atm: Liquid 13.2 Moleculer Weight: Not pertinent
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: Not pertinent 13.3 Boiling Point at 1 atm: 349 - 349°T = 176 - 28°T C = 449 - 560°K
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: 1 good 13.2 Molecular Weight: Not pertunent 13.3 Boiling Point at 1 atm: 349 - 449°1 = 176 287°C = 449 - 861°K
12.1	ISee Hazard Assessment Händbook CG 446-3) A · T · U	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: Not pertinent 13.3 Boiling Point at 1 atm: 349 - 349°T = 176 - 28°T C = 449 - 560°K
12.1	See Hazard Assessment Handbook CG 446-31 A-T-U  12. HAZARD CLASSIFICATIONS	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: Liquid  13.2 Molecular Weight: Not perturent  13.3 Bolling Point at 1 atm: 34° ×49°1  = 176 ×28°C = 449 ×60 K  13.4 Freezing Point:  - >44°1 = < -48 C = < 22° K
12.1	1See Hazard Assessment Handbook CG 446-31 A-T-U  12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not perturbed  13.3 Boiling Point at 1 atm: 34° ×40°!  = 176 28°C = 440 ×60 k  13.4 Freezing Point:  <
	See Hazard Assessment Handbook CG 446-31 A-T-U  12. HAZARD CLASSIFICATIONS Code of Faderal Regulations: Flammable liquid	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 road  13.2 Molecular Weight: Not pertuent  13.3 Boiling Point at 1 atm: 340 ×49°1  = 176 28°C = 449 ×60 k  13.4 Freezing Point:  <
	1See Hazard Assessment Handbook CG 446-31 A-T-U  12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: I iquid  13.2 Molecular Weight: Not pertonent  13.3 Boiling Point at 1 atm: 34° 549°1  = 176 28°7°C = 449°50° K  13.4 Preszing Point:  <-54°1 = <-48 C = <22° K  13.5 Critical Temperature: Not pertonent  13.6 Critical Temperature: Not pertonent  13.7 Specific Gravity: 0.81 at 20° C (liquid)
	1See Hazard Assessment Handbook CG 446-31 A-T-U  12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water Transportation:	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State of 15°C and 1 atm: Liquid  13.2 Moleculer Weight: Not pertinent  13.3 Boiling Point at 1 atm: 340 ×49°1  = 176 287°C = 449 ×60°K  13.4 Freezing Point:  <
	1See Hazard Assessment Handbook CG 446-31 A.TU  12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Filammable liquid NAS Hazard Rating for Bulk Water Transportation: Category Rating	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: Liquid  13.2 Molecular Weight: Not pertunent  13.3 Boiling Point at 1 atm: 349 - 549 - 1 atm 176 - 25°C = 449 - 500 K  13.4 Freezing Point: < -54°C = 52°C k  13.5 Critical Temperature: Not pertunent  13.6 Critical Pressure: Not pertunent  13.7 Specific Gravity: 0.51 at 20 C (diquid)  13.8 Liquid Surface Tension: (cst 12°S) percent = 0.05°N - m at 20 C (est 12°S) percent = 0.05°N - m at 20 C (est 12°S) of the control of t
	12. NAZARD CLASSIFICATIONS  Code of Faderal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire Health Vapor Irritant  1	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quad  13.2 Molecular Weight: Not pertuent  13.3 Boiling Point at 1 atm: 340 × 49°1 = 176 × 28°C = 449 × 60° K  13.4 Freezing Point: < -449 × 60° K  13.5 Critical Pressure: Not pertuent  13.6 Critical Pressure: Not pertuent  13.7 Specific Gravity: 0.81 at 20° C (quad)  13.8 Liquid Surface Tension: (est 2.2 shapes cm = 0.02 N m at 20° C (cs) 2.2 shapes cm = 0.02 N m at 20° C (13° U) Sodynes cm = 0.08 N m at 20° C (13° U) Sodynes cm = 0.08 N m at 20° C (13° U) Specific Gravity: (13°
	1See Hazard Assessment Handbook CG 446-31 A-T-U  12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable Inquid NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire I Health Vapor Irritant I inquid or Solid Irritant I	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not pertonent  13.3 Boiling Point at 1 atm: 34° 549°1  = 176 287°C = 449°560°K  13.4 Freezing Point:  <-54°1 = <-44° = <-22° K  13.5 Critical Temperature: Not pertonent  13.6 Critical Temperature: Not pertonent  13.7 Specific Gravity: 0.81 at 20°C (liquid)  13.8 Liquid Surface Tension:  (65.1.25 disection = 0.02°N mail 20°C  13.9 Liquid-Water Interfacial Tension: (65.1.50 disection = 0.08°N mail 20°C  13.10 Vapor (Gae) Specific Gravity: Not pertonent
	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Fiammable liquid NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 8 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Possins 1	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not pertinent  13.3 Boiling Point at 1 atm: 349 - 549°L  13.4 Freezing Point:  <-54°L = <-48 C = <22° K  13.5 Critical Temperature: Not pertinent  13.6 Critical Pressure: Not pertinent  13.7 Specific Gravity: 0.81 at 20°C (iquid)  13.8 Liquid Surface Tension:  (est 12°S) dispession = 0.02° N in at 20°C  13.9 Liquid-Water Interfacial Tension: (est 180 dynes om = 0.08° N intat 20°C  13.10 Vapor (Gas) Specific Gravity: Not pertinent  13.11 Retio of Specific Heets of Vapor (Gas):
	12. HAZARD CLASSIFICATIONS  Code of Faderal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Heath Vapor Irritant 1 Liquid or Solid Irritant 1 Puisons 1 Water Pollution	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 road  13.2 Molecular Weight: Not pertinent  13.3 Boiling Point at 1 atm: 340 - 440·1  = 176 - 28°C = 449 - 460 K.  13.4 Freezing Point:  <
	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable layed NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Firstant 1 Poisons 1 Water Pollution Human Toxicity 1	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not pertonent  13.3 Boiling Point at 1 atm: 340 549°1  = 176 28°7°C = 449 560 K  13.4 Freezing Point:  <-34°1 = <-44° = <-22° K  13.5 Critical Temperature: Not pertonent  13.6 Critical Temperature: Not pertonent  13.7 Specific Gravity: 0.81 at 20°C (liquid)  13.8 Liquid Surface Tension:  (est ) 25 dynes cm = 0.02° N m at 20°C  13.9 Liquid-Water Interfacial Tension: (est ) 30 dynes cm = 0.08° N, m at 20°C  13.10 Vapor (Qae) Specific Gravity: Not pertonent  13.11 Ratio of Specific Heats of Vapor (Gae): (est ) 1.030  13.12 Latent Heat of Vaporization:
	12. HAZARD CLASSIFICATIONS  Code of Faderal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Heath Vapor Irritant 1 Liquid or Solid Irritant 1 Puisons 1 Water Pollution	13. Physical AND CHEMICAL PROPERTIES
	12. NAZARD CLASSIFICATIONS  Code of Federal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Water Pollution Human Toxicity 1 Aquatic Toxicity 3	13. PHYSICAL AND CHEMICAL PROPERTIES
	1. NAZARD CLASSIFICATIONS Code of Federal Regulations: Fiammable liquid NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Poisson 1 Water Pollution Human Toxicity 1 Aquatet Toxicity 1 Aquatet Toxicity 1	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not pertinent  13.3 Boiling Point at 1 atm: 340 - 449°1  = 176 - 28°C = 449 - 860 K  13.4 Freezing Point:
	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water  Transportation:  Category Rating Fire 3  Health Vapor Irritant 1  Liquid or Solid Irritant 1  Possons 1  Water Pollution  Human Toxicity 1  Aquatic Toxicity 1  Accidente Heet 3  Reactivity Other Chemicals 0  Water 0	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not pertinent  13.3 Boiling Point at 1 atm: 340 - 449·1  = 176 - 28°7°C = 449 - 860 k  13.5 Critical Temperature: Not pertinent  13.6 Critical Temperature: Not pertinent  13.7 Specific Gravity: 0.81 at 20 C (diquid)  13.8 Liquid Surface Tension:  (est.) 25 dynes cm = 0.028 N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est.) 90 dynes cm = 0.08 N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not pertinent  13.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1 0.81  13.12 Latent Heat of Vapor ization: 140 Biu, lb = 78 cal g = 3.3 × 10.3 kg  13.13 Heat of Combustion: -18, 540 Biu lb = -10,300 cal g = -441.24 × 10.3 kg  13.14 Heat of Decomposition: Not pertinent
12.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Aquatic Toxicity 1 Aquatic Toxicity 1 Aquatic Toxicity 1 Accitety Other Chemicals 0 Water 0 Self-Reaction 0	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quid  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 - 549 · 1  = 176 - 28°C = 449 - 560 k  13.4 Freezing Point:  <= ~4°   1 = < -4 k (= < 22° k)  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 0.81 at 20 c (diquid)  13.8 Liquid Surface Tension: (est ) 2° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est ) 50 dynes cm = 0.08° N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not perturent  13.11 Ratio of Specific Heats of Vapor (Gas): (est ) 1.030  13.12 Latent Heat of Vaporization:  140 Bits (b = 78 cd g = 3.4 × 10.3 kg  13.13 Heat of Combustion: −18, 340 Bits (b = −10,30, cd g = −43.1 × 10.3 kg  13.14 Heat of Combustion: −18, 540 Bits (d)  13.15 Heat of Specific Not perturent
	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Water Pollution Human Toxicity 1 Aquatic Toxicity 1 Acythetic Toxicity 1 Acythetic Fifect 3 Reactivity Other Chemicals 0 Water 0 Self-Reaction 0  NFFA Hazard Classifications:	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 iquid  13.2 Molecular Weight: Not pertinent  13.3 Boiling Point at 1 atm: 340 - 449·1  = 176 - 28°7°C = 449 - 860 k  13.5 Critical Temperature: Not pertinent  13.6 Critical Temperature: Not pertinent  13.7 Specific Gravity: 0.81 at 20 C (diquid)  13.8 Liquid Surface Tension:  (est.) 25 dynes cm = 0.028 N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est.) 90 dynes cm = 0.08 N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not pertinent  13.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1 0.81  13.12 Latent Heat of Vapor ization: 140 Biu, lb = 78 cal g = 3.3 × 10.3 kg  13.13 Heat of Combustion: -18, 540 Biu lb = -10,300 cal g = -441.24 × 10.3 kg  13.14 Heat of Decomposition: Not pertinent
12.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Flammable liquid NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Aquatic Toxicity 1 Aquatic Toxicity 1 Aquatic Toxicity 1 Accitety Other Chemicals 0 Water 0 Self-Reaction 0	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quid  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 - 549 · 1  = 176 - 28°C = 449 - 560 k  13.4 Freezing Point:  <= ~4°   1 = < -4 k (= < 22° k)  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 0.81 at 20 c (diquid)  13.8 Liquid Surface Tension: (est ) 2° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est ) 50 dynes cm = 0.08° N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not perturent  13.11 Ratio of Specific Heats of Vapor (Gas): (est ) 1.030  13.12 Latent Heat of Vaporization:  140 Bits (b = 78 cd g = 3.4 × 10.3 kg  13.13 Heat of Combustion: −18, 340 Bits (b = −10,30, cd g = −43.1 × 10.3 kg  13.14 Heat of Combustion: −18, 540 Bits (d)  13.15 Heat of Specific Not perturent
12.2	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Fiammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 8 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Possons 1 Water Pollution Human Tossesty 1 Aquatic Tossesty 1 Acethetic Effect 3 Reactivity Other Chemical 0 Water 0 Self-Reaction 0  NFPA Hazard Classifications: Category Classification Health Hazard (Blue) 0	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quid  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 - 549 · 1  = 176 - 28°C = 449 - 560 k  13.4 Freezing Point:  <= ~4°   1 = < -4 k (= < 22° k)  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 0.81 at 20 c (diquid)  13.8 Liquid Surface Tension: (est ) 2° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est ) 50 dynes cm = 0.08° N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not perturent  13.11 Ratio of Specific Heats of Vapor (Gas): (est ) 1.030  13.12 Latent Heat of Vaporization:  140 Bits (b = 78 cd g = 3.4 × 10.3 kg  13.13 Heat of Combustion: −18, 340 Bits (b = −10,30, cd g = −43.1 × 10.3 kg  13.14 Heat of Combustion: −18, 540 Bits (d)  13.15 Heat of Specific Not perturent
12.2	12. HAZARD CLASSIFICATIONS  Code of Faderal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Health Water Pollution Human Toxicity 1 Aquatte Toxicity 1 Acethetic Effect 3 Reactivity Other Chemicals 0 Water 0 Water 0 NFPA Hazard Classifications: Category Classifications Hazard (Blue) 0 Flammability (Red) 2	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quid  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 - 549 · 1  = 176 - 28°C = 449 - 560 k  13.4 Freezing Point:  <= ~4°   1 = < -4 k (= < 22° k)  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 0.81 at 20 c (diquid)  13.8 Liquid Surface Tension: (est ) 2° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est ) 50 dynes cm = 0.08° N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not perturent  13.11 Ratio of Specific Heats of Vapor (Gas): (est ) 1.030  13.12 Latent Heat of Vaporization:  140 Bits (b = 78 cd g = 3.4 × 10.3 kg  13.13 Heat of Combustion: −18, 340 Bits (b = −10,30, cd g = −43.1 × 10.3 kg  13.14 Heat of Combustion: −18, 540 Bits (d)  13.15 Heat of Specific Not perturent
12.2	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Fiammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 8 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Possons 1 Water Pollution Human Tossesty 1 Aquatic Tossesty 1 Acethetic Effect 3 Reactivity Other Chemical 0 Water 0 Self-Reaction 0  NFPA Hazard Classifications: Category Classification Health Hazard (Blue) 0	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quid  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 - 549 · 1  = 176 - 28°C = 449 - 560 k  13.4 Freezing Point:  <= ~4°   1 = < -4 k (= < 22° k)  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 0.81 at 20 c (diquid)  13.8 Liquid Surface Tension: (est ) 2° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est ) 50 dynes cm = 0.08° N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not perturent  13.11 Ratio of Specific Heats of Vapor (Gas): (est ) 1.030  13.12 Latent Heat of Vaporization:  140 Bits (b = 78 cd g = 3.4 × 10.3 kg  13.13 Heat of Combustion: −18, 340 Bits (b = −10,30, cd g = −43.1 × 10.3 kg  13.14 Heat of Combustion: −18, 540 Bits (d)  13.15 Heat of Specific Not perturent
12.2	12. HAZARD CLASSIFICATIONS  Code of Faderal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Health Water Pollution Human Toxicity 1 Aquatte Toxicity 1 Acethetic Effect 3 Reactivity Other Chemicals 0 Water 0 Water 0 NFPA Hazard Classifications: Category Classifications Hazard (Blue) 0 Flammability (Red) 2	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 road  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 s49°1  = 176 28°C = 449 s60 k  13.4 Freezing Point:  <-34°1 = <-48 C = <22° k  13.5 Critical Pressure: Not perturent  13.6 Critical Pressure: Not perturent  13.7 Specific Gravity: 0.81 at 20 C (liquid)  13.8 Liquid Surface Tension: (est 12° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est 19° 0 dynes cm = 0.08° N m at 20 C  13.10 Vepor (das) Specific Gravity: Not perturent  13.11 Retic of Specific Heats of Vapor (Gas): (est 10 0.00  13.12 Laterit Heat of Vaporization:  14.0 Bru th = 78°cd y = 3.3 × 10° J kg  13.14 Heat of Combustion: -18,840 Bru th  = -10,300 cat y = -43.1 × 10° J kg  13.14 Heat of Composition: Not perturent  13.15 Heat of Solution: Not perturent  13.16 Heat of Polymerization: Not perturent
12.2	12. HAZARD CLASSIFICATIONS  Code of Faderal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Liquid or Solid Irritant 1 Health Water Pollution Human Toxicity 1 Aquatte Toxicity 1 Acethetic Effect 3 Reactivity Other Chemicals 0 Water 0 Water 0 NFPA Hazard Classifications: Category Classifications Hazard (Blue) 0 Flammability (Red) 2	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 quid  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 - 549 · 1  = 176 - 28°C = 449 - 560 k  13.4 Freezing Point:  <= ~4°   1 = < -4 k (= < 22° k)  13.5 Critical Temperature: Not perturent  13.6 Critical Temperature: Not perturent  13.7 Specific Gravity: 0.81 at 20 c (diquid)  13.8 Liquid Surface Tension: (est ) 2° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est ) 50 dynes cm = 0.08° N m at 20 C  13.10 Vapor (Gas) Specific Gravity: Not perturent  13.11 Ratio of Specific Heats of Vapor (Gas): (est ) 1.030  13.12 Latent Heat of Vaporization:  140 Bits (b = 78 cd g = 3.4 × 10.3 kg  13.13 Heat of Combustion: −18, 340 Bits (b = −10,30, cd g = −43.1 × 10.3 kg  13.14 Heat of Combustion: −18, 540 Bits (d)  13.15 Heat of Specific Not perturent
12.2	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Flammable liquid  NAS Hazard Rating for Bulk Water  Transportation: Category Rating Fire 3 Health Vapor Irritant 1 Liquid or Solid Irritant 1 Possons 1 Water Pollution Human Toxicity 1 Aquatic Toxicity 1 Aquatic Toxicity 1 Accitetic Fifect 3 Reactivity Other Chemicals 0 Water 0 Self-Reaction 0  NPPA Hazard Classifications: Category Classification Health Hazard (Blue) 0 Flammability (Red) 2 Reactivity (Yellow) 0	13. PHYSICAL AND CHEMICAL PROPERTIES  13.1 Physical State at 15°C and 1 atm: 1 road  13.2 Molecular Weight: Not perturent  13.3 Boiling Point at 1 atm: 340 s49°1  = 176 28°C = 449 s60 k  13.4 Freezing Point:  <-34°1 = <-48 C = <22° k  13.5 Critical Pressure: Not perturent  13.6 Critical Pressure: Not perturent  13.7 Specific Gravity: 0.81 at 20 C (liquid)  13.8 Liquid Surface Tension: (est 12° dynes cm = 0.02° N m at 20 C  13.9 Liquid-Water Interfacial Tension: (est 19° 0 dynes cm = 0.08° N m at 20 C  13.10 Vepor (das) Specific Gravity: Not perturent  13.11 Retic of Specific Heats of Vapor (Gas): (est 10 0.00  13.12 Laterit Heat of Vaporization:  14.0 Bru th = 78°cd y = 3.3 × 10° J kg  13.14 Heat of Combustion: -18,840 Bru th  = -10,300 cat y = -43.1 × 10° J kg  13.14 Heat of Composition: Not perturent  13.15 Heat of Solution: Not perturent  13.16 Heat of Polymerization: Not perturent

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#### **MALATHION**

on Syr 6. FIRE HAZAROS 8. WATER POLLUTION Yellow to dark brown Skunk-like odor Flesh Point: > 325"F 8.1 Aquatic Taxicity: ommebio Limito in Air: Data not available 0.09 ppm/96 hr/bluegill/TLm/fresh water 0.033-0.083 ppm/96 hr/marine crustaceae/ links in water. Freezing point is 370 F LC. AVOID CONTACT WITH LIQUID. Keep people away. 6.3 Fire Extinguishing Agents: Dry chemical, erland Taxiolty: LDn=1485 mg/kg carbon dioxide, water spray, foam Wear chemical protective suit with self-contained Stop discharge if possible.

Call fire department, loads to the self-contained solute and remove discharged material Notify local health and pollution control agencies 8.3 Biological Oxygen Demand (BOD): Data not available Fire Extinguishing Agents Not to be Used: Not pertinent 8.4 Food Chain Conce Special Hazards of Comb hazardous. They include sulfur dioxide Combustible
POSCONOUS CASES ARE PRODUCED IN FIRE AND WHEN HEATED
West Chemical profiled in fire
West Chemical profiled in fire
West Chemical profiled in the West-Contained breathing apparatus.
Extinguish with dry Chemical, carbon dioxide, water, or foam.
Cool exposed containers with water and phosphoric acid 6.6 Behavior in Fire: Gives off hazardous fumes. Area surrounding fire should be diked to prevent water runoff 9. SELECTED MANUFACTURERS Fire merican Cyanamid Co. nition Temperature: Data not available 6.8 Electrical Hazard: Not pertinent Agricultural Division P. O. Box 400 6.9 Burning Rate: Data not available Princeton, N. J. 08540 ALL FOR MEDICAL AID LIQUID POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED 7. CHEMICAL REACTIVITY REMOVED THE ACTION OF THE SAN IS EAROSED REMOVED THE SAN IS EAROSED THE SAN ctivity with Water: None 7.2 Reactivity with Comm No hazardous reaction Stability During Transport: Not pertinent Exposure Neutralizing Agents for Acids and Causties: Liquid bleach solution for 7.5 Polymerization: Not pertinent 18. SHIPPING INFORMATION 7.6 Inhibitor of Polymerization: 10.1 Grades or Purity: CYTHION Insecticide; Malathion ULV Concentrate Insecticide, Many powders, dusts, and spray solutions are sold under a variety of trade names. HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS 10.2 Storage Temperature: Below i 20° F Decomposition (non-hazardous) May be dangerous if it enters water intakes Notify local health and wildlife officials. Notify operators of nearby water intakes. **Pollution** occurs at higher temperatures 10.3 Inert Atmosphere: Data not available 10.4 Venting: Data not available 1. RESPONSE TO DISCHARGE 11. HAZARD ASSESSMENT CODE 13. PHYSICAL AND CHEMICAL PROPERTIES 2. LABEL 13.1 Physical State at 15°C and 1 atm: Liquid mi Handbook, CG 446-3) Issue warning poison, water 13.2 Molecular Weight: 330 36 A-X-Y 13.3 Bolling Point at 1 atm: Very high Restrict access 13.4 Freezing Point: 37°F = 2 9°C = 276°K 13.5 Critical Temperature: Not pertinent Chemical and physical treatment 12. HAZARD CLASSIFICATIONS 13.6 Critical Pressure: Not pertinent 12.1 Gode of Federal Regulations: Poisonous figured or solid, Class B 13.7 Specific Gravity: 1.234 at 25 °C (liquid) 3. CHEMICAL DESIGNATIONS 4. OBSERVABLE CHARACTERISTICS 13.8 Liquid Surface Tension: 37.1 dynes/cm = 0.0371 N/m at 24°C 4.1 Physical State (se shipped): 1.iquid Synanyma: CYTHION Insecticide 12.2 NAS Hazard Rating for Sulk Water 4.2 Color: Yellow to dark brown Transportation: Not listed 13.9 Liquid-Water Interfacial Tensi 4.3 Odor: Characteristic skunk-like 12.3 NFPA Hazard Classification 19 dynes/cm = 0.019 N/m at 24°C 13.10 Vapor (Gee) Specific Gravity: Not pertinent Not applicable nical Formula: CoHoO.PS: 13.11 Ratio of Specific Heats of Vapor (Gas): HICO/United Nations No Designation: 6.1/1893 Not pertinent 13 12 Latent Heat of Vaports Not pertinent 13.13 Heat of Combustion: Data not available 5. HEALTH HAZARDS irsenal Pretective Equipment: Wear self-contained breathing apparatus (or respirator for organophosphate pesticides) and rubber clothing while fighting fires of mulathion with 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: Not pertinent chlorine bleach solution. All clothing contaminated by fumes and vapors must be decontaminated 13.16 Heat of Polymerization: Not pertinent 5.2 Synctome Following Exposure: Exposure to fumes from a fire or to liquid causes headache, blurred vision, constricted pupils of the eyes, weakness, nausea, cramps, diarrhea, and tightness in the chest. Muscles twitch and convulsions may follow. The symptoms may develop over a period of 8 hours. treent for Exposure: Speed is essential. INHALATION: in the nonbreathing victim values of lagrounce. Speed is essential. INHALATION in the nonbreathing victim immediately institute artificial respiration, using the mouth-to-mouth, the mouth-to-nose, or the mouth-to-oropharyngeal method. Call physician! INGESTION: administer milk, water or salt-water and induce vointing repeatedly. SKIN OR E-YE-CONTACT: flood and wash exposed kin areas thoroughly with water. Remove contaminated clothing under a shower. Administer atropine, 2 mg (1/30 gr) intramuscularly or intravenously as soon as any local or systemic signs or symptoms of an intosication are noted, repeat the administration of atropine every 3-8 min. until signs of atropinization (mydrasis, dry mouth, rapid pulse, hot and dry skin) occur; initiat treatment in children with 1 mg of atropine. Watch respiration, and remove honochial secretions if thes appear to be obstructions the array intubate if 5. HEALTH HAZARDS (Cont'd.) shold Limit Value): 10 mg/m³ 5.5 Short-Term inhelation Limits: Data not available 5.6 Toxicity by ingustion: Grade 2;  $LD_{10}$  0.5 to 5 g/kg (rat) and dry skin) occur; initiate treatment in children with I mg of atropine. Watch respiration, and remove bronchial secretions if they appear to be obstructing the airway, initiable of necessary. Give 2-PAM (Pralidoxime, Protopiam), 2.5 gm in 100 mt of sterile water or in 5% deatrose and water, intravenously, slowly, in 15-30 mm, if sufficient fluid is not available, give 1 gm of 2-PAM in 3 mt of divilled water by deep intramissional rinjection, repeat this every half hour if respiration, weakens or if muscle fasciculation or convolvious recui 5.7 Late Youlelly: Data not available 5.8 Vapor (Gee) Irritant Characteristics: None likely 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard If spilled on clothing and allowed

to remain, may cause smarting and reddening of the skin

5.10 Odor Throshold: Data not available

#### METHYL ALCOHOL

Floats and mixes with water. Flammable, irritating vapor is produced Stop discharge if possible. Keep people away, Shut off figuition sources and cell fire department. Skay upwind and use water spary to "Inock down" vapor Avoid contact with liquid and vapor Isolate and remove discharged material. Notify local health and pollution control agencies. FLAMMABLE.
Vapor may explode if ignifed in an enclosed area.
Flashback along vapor trail may occur.
Extinguish with dry chemical, alcohol foam, or carbon dioxide.
Water may be ineffective on fire.
Coud exposed containers with water. Fire CALL FOR MEDICAL AID. VAPOR
Irritating to eyes, nose and throat.
If inhabed, will cause dizziness, headache, difficult breathing, or loss of consciousness.

More to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen. LOUID POISONOUS IF SWALLOWED Irritating to skin and eyes.

Remove contaminated clothing and shoes. Flush affected areas with plenty of water.

IF IN EY! ". hold cyclick open and flush with plenty of water.

IF SWALLOWED and victim is CONSCIOUS, have victim drink water or nillk and have victim induce vonting.

IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm. Exposure Dangerous to aquatic life in high concentrati May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes. Water Pollution 1. RESPONSE TO DISCHARGE 2. LABEL Issue warning high flammability Evacuate area Disperse and flush 3. CHEMICAL DESIGNATIONS 4. OBSERVABLE CHARACTERISTICS Colonial spirit Wood alcohol Columbian spirit Wood naphtha Methanol Wood spirit 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Faint alcohol; like ethyl alcohol; 3.2 Const Guard Compatibility Classification:
Alcohol faintly sweet; characteristic pungent 3.3 Chemical Formula: CH<sub>1</sub>OH 3.4 IMCO/United Nations III Designation: 3.2/1230 5. HEALTH HAZARDS MC Approved canister mask for high vapor concentrations; safety goggles, rubber gloves Symptoms Pediousing Exposure: Exposure to excessive vapor causes eye teritation, head-ache, fatigue and drowsiness. High concentrations can produce central nervous system depression and optic nerve damage. 50,000 ppm will prohably cause death in 1 to 2 hrs. Can be absorbed through skin. Swallowing may cause death or eye damage. 5.3 Transformant for Exposures: Remove victim from exposure and apply artifical respiration if breathing has ceased. INGESTION: induce vomiting, then give 2 (easpoons of baking soda in glass of water; call a physician. SKIN OR EYES: flush with water for 15 min. Toxicity by Inhabation (Threshold Limit Value): 200 ppm Short-Term Inhalation Limits: 260 mg/m<sup>3</sup> for 60 min. 5.6 Toxicity by Ingestion: Grade 1; 5 to 15 g/kg (rat) 5.7 Late Textelly: None 5.8 Vepor (Gao) hythant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary. 5.9 Useful or Solid by Land Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Throubald: 100 ppm

6. FIRE HAZARDS 5.1 Flash Point: 54°F.C.C., 61°F.O.C. 6.2 Flammable Limits in Air: 6.0°C. 36.5°C. 6.3 Fire Extinguishing Agents: Alcohol foam, dry chemical, or carbon dioxide. 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective. 6.5 Special Hazards of Combustion Products: Not pertinent. 6.6 Behaviog in Fire: Contuners may explode. 6.7 Ignition Temporature: 86.7°E. 6.8 Electrical Hazard: Class I, Group D. 6.9 Burming Rate: 1.7 mm/min.	8. WATER POLLUTION 8.1 Aquestic Toxicity: 230 ppm/11 http:goldfish/died/fresh water 8.2 Waterboar Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0.6 to 1.12 lb/lb in 5 days 8.4 Food Chain Concentration Potential: Nonc
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: No reaction 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acide and Caustics: Not perturent	9. SELECTED MANUFACTURERS  1. Borden Inc Borden Chemical Dission Geismar, La. 70734  2. Celanese Corp. Celanese Corp. Celanese Chemical Co. Dission 245 Park. Ave. New York, N. Y. (10017)  3. E. I. du Pont de Nemours & Co., Inc. Industrial and Biochemical Dept. Wilmington, Del. 19898
7.5 Polymerization: Not pertunent 7.6 Inhibitor of Polymerization: Not pertunent	10. SHIPPING INFORMATION  10.1 Grades or Purity: C.P., Crude, ACS all 90-97.  10.2 Storage Temporature: Ambient Inert Atmosphers: No requirement 4 venting: Open (flame arrester) or pressure-vacuum
11. HAZARD ASSESSMENT CODE (See Mazard Assessment Handbook, CG 446-3) A. PQRS	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: 1 iquid 13.2 Molecular Weight: 32 04 13.3 Boiling Point at 1 atm: 144 1°1 = 045°C = 337°°K
12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable liquid 12.2 NAS Hazard Rating for Bulk Water Transportation: Category Rating Fire 3	13.4 Freezing Point: -144 0°F = -97 8°C = 175 4°K  13.5 Critical Yengersture: 464°F = 240°C = 513°K  13.6 Critical Pressure: 1142 0 piss = 77.7 atm = 7.87 MN/m¹  13.7 Specific Gravity: 0.792 at 20°C (Iquid)  13.8 Liquid Surface Tension: Not pertinent
Health Vapor Irritant Liquid or Solid Irritant I Poisons 2 Water Pollution Human Toxicity Aquatic Toxicity I Acsthetic Effect Reactivity Other Chemicals 2 Water 0	13.9 Liquid-Water Interfacial Tension:  Not pertinen:  13.10 Vapor (Gae) Specific Gravity: 1 I  13.11 Ratio of Specific Heats of Vapor (Gae):  1.254  13.12 Letent Heat of Vaportization: 473.0 Btu/lb  202 8 cat/g = 11.00 × 10° J/kg  13.13 Heat of Combustion: -1419 Btu/lb  -4677 cat/g = -195.8 × 10° J/kg  13.14 Heat of Decomposition: Not pertinent
Water 0 Self-Reaction 0  12.3 NFPA Hazard Classifications:	13.15 16 at of Solution: (est.) =9 Btu/lb = -5 csl/g = -0.2 × 10 J/kg  13.16 Heat of Polymerization: Not pertured.

NOTES

Classification

13.16 Heat of Polymerization: Not pertinent

3

Category

Health Hazard (Blue) Flammability (Red) Reactivity (Yellow)

### **METHYLHYDRAZINE**

Common Synony	ms T				1 -	
Monomethythydrai MANH		Liquid Mixes with water: F	Colortess oisonous, flammable vap	Ammonia-like odor or is produced.	6 1 6 2 6 3	6. FIRE HAZARDS Fleeh Point: 62°F O C Flemmeble Limits in Air: 3 Fire Extinguishing Agents: dty chemical
Wear goggles Shut off ignit Stop discharg Stay upwind Isolate and re	and self-con- tion sources, e if possible. Use water s more discha	tained breathing ap Call fire departmen	it. vn'' vapor	VAY.	64 65 66 67	Fire Extinguishing Agents Not pertinent Special hazards of Comba Irritating nitrogen oxides Schavier in Fire: May expl Ignition Temperature: 382
Fire	Flashback Vapor may May explo Extinguish Water may	MABLE  NAME of the second of t				Electrical Masard: Data no Burning Rote: 20 mm/min
Exposure	Irritating I Move vict If breathin If breathin LiQUID POISONO Will burn a Remove c Flush affe IF IN EY! IF SWALL or m	US IF INHALED O to eyes, nose and the into fresh air- ng has stopped, give ing is difficult, give of US IF SWALLOWE skin and eyes. Toottaminated clothic refed areas with plet FS, hold eyelids opp	artificial respiration.  DOR IF SKIN IS EXPO  and shoes.  To and flush with plenty is CONSCIOUS, have vice.	SED.	73	7. CHEMICAL REACT Reactivity with Water: No Reactivity with Common it slowly with June and of rage, rust, or other con Stability During Transport in contact with rone, copy alloys Neutralizing Agents for Ac Caustics: Flush with water Polymerization: Not pertir Inhibitor of Polymerization
Water Pollution	May be day Notify loc	ow concentrations on gerous if it enters cal health and wildli erators of nearby w	fe officials.	n.		
1. RESPONS (See Response Mee Issue warning flammabilit air contamit Restrict access	poison, hig y, water cont pant	k, CG 446-4) kh		POISON		11. HAZARD ASSESSME (See Hezerd Assessment Handbo A-P-Q-R-S
1 Synonyme Mills 1 Synonyme Mills 1 Synonyme Mills 1 Synonyme Mills 1 Coast Guard C Not applicab 3 Chemical Form 3 IntCO/United it Designation: 1	AL DESIGN/ momethylhy propertibility te rule: CHIN tetions Num	drazine: y Classification: HNH:				12. HAZARD CLASSIFIC Code of Federal Regulative Flammable liquid NAS Hazard Rating for Stransportation: Category Fire Health Vapor Irritant Liquid or Solid Irritan Poisons Water Pollution
goggles or fac 5 2 Symptome Folk Inhalation ca Contact of lic mouth and st 5 3 Treatment for E INHALATE hreathing sto immediately give gg while	e shield; ruh owing Expa uses focal irr juid with eye omach ixposure: ( ON: move vi py EYES: fl wash with la es or other et	ment: Organic can ober gloves; protecti paura: Fremors and intation of respirator is or skin causes irri- tiet medical attention tetim to fresh air and losh for at least 15 in rige quantities of wa mollient, followed h	convulsions follow absor- ry tract, respiratory distri- tation and burns. Ingestic	ntion by any route, see, and systemic effects, nearest irritation of powers to this compound ificial respiration if of water. SKIN: burn 1 NGESTION bern mild emile.	12.3	Human Toxicity Aquatic Toxicity Aesthetic Effect Reactivity Other Chemicals Water Self-Reaction NFPA Hazard Classificat Category Health Hazard (Blue) Flammability (Red) Reactivity (Yellow)
administered 5.4 Texicity by Inhic 5.5 Short-Term inh 5.6 Texicity by Ingi 5.7 Late Texicity: 5.8 Vapor (Gos) Irr	parenterally station (Thr salation: Lim selion: Grad Hemolytic a Rant Chara	r by a physician with <b>schold Limit Value</b> <b>MRC</b> : 90 ppm for 10 de 4; oral LD <sub>50</sub> = 33 nemia may result fr	i due regard for depression  10: 0.2 ppm  min.; 30 ppm for 30 min.  mg/kg (rat)  om large doses by any roi  are moderately irritating	n of respiration. . 15 ppm for 60 min. ste.	1 1	Liquid or Solid Irritont Ch hurns on short contact at ) Odor Threshold: 1 3 ppri

6. FIRE MAZARDS 6.1 Plack Point: 62°F O.C 6.2 Plantmable Limbts in Air: 2.5% 98% 6.3 Pire Extinguishing Agents: Water or dry chemical 6.4 Fire Extinguishing Agents Not to be Used: Not perfuent 6.5 Special huxards of Combustion Products: Irritating introgen oxides are produced 6.6 Behalter in Fires: May explode 6.7 Ignition Temperature: 382°F	8. WATER POLLUTION  8.1 Aquetic Texicity: Data not available 8.2 Waterfood Texicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Feed Chain Concentration Potential: None
68 Electrical Hazard: Data not available 69 Burning Rate: 20 mm/min	9. SELECTED MANUFACTURERS  1. Olin Corporation 1201 Long Ridge Road Stamford, Conn. 06904  2. Eastman Kodak Co Eastman Organic Chemicals Rochester, N. Y. 14650
7. CHEMICAL REACTIVITY 7.1 Reactivity with Water: No reaction 7.2 Reactivity with Common Materials: Reacts slowly with air, but heat may cause signition of rags, rust, or other combustibles. 7.3 Stability During Transport: Stable if not in contact with iron, copper, or their alloys.	Aldrich Chemical Co.  940 West St. Paul Ave.  Milwaukee: Wis. 53233
7 4 Neutralizing Agents for Acids and Caustics: Flush with water 7 5 Polymerization: Not pertinent 7 6 Inhibitor of Polymerization: Not pertinent	10. SHIPPING INFORMATION  10.1 Grades or Purity: Propellant grade. 99+% Laboratory grade. 98+'  10.2 Storage Temperature: Ambient  10.3 Inert Atmosphere: Padded with nitrogen  10.4 Venting: Safety relief
11. HAZARD ASSESSMENT CODE (See Mazard Assessment Handbook CG 446-3) A+P-Q+R+S	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid 13.2 Molecular Weight: 46.1 13.3 Boiling Point at 1 atm: 189.5°F = 87.5°C = 360.7°K
12. HAZARD CLASSIFICATIONS 12.1 Code of Federal Regulations: Flammable liquid 12.2 NAS Hazard Reting for Bulk Water	13.4 Freezing Point: -62.3°F = -52.4°C = 220 k°k 13.5 Critical Temperature: 594°F = 112°C = 585°k 13.6 Critical Pressure: 1,195 poia = 81.3 atm = 8.25 MN m
Transportation:   Colegory   Reling   Fire   4   Health   Vapor Irritant   4   Poisons   4   Water Pollution   Human Toxicity   4   Aquaite Toxicits   Aesthetic Effect   2   Reactivity   Chier Chemicals   4   Water   0   Self-Reaction   4   Self-Reaction   4   Colembra   5   Colembra   5	13.7 Specific Gravity: 0.878 at 20°C (figure)  13.8 Liquid Surface Tension:  34.3 dines/cm = 0.0343 \times at 20°C  13.9 Liquid-Water Interfacial Tension:  Not pertinent  13.10 Vapor (Gas) Specific Gravity: 1.59  13.11 Ratio of Specific Heats of Vapor (Gas):  1.1326  13.12 Latent Heat of Vaporization: 3°n Btu th = 209 cat/g = 8.75 \times 10°3 Btu /th = 6.766 cat/g = -28.31 \times 10°3 kg  13.14 Heat of Combustion: -12,178 Btu/th = 6.766 cat/g = -28.31 \times 10°3 kg  13.14 Heat of Decomposition: Not pertinent

#### 5. HEALTH HAZARDS (Cont'd.)

13 15 Heat of Solution: Not pertinent

- quid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree hurns on short contact and is very injurious to the eyes.

  dor Threshold: 1 3 ppm.

### NAPHTHA: STODDARD SOLVENT

				-	
Common Synon Petralisms solvent Dryclesser neglish Spotting naphtha	Watery liquid Floats on water	Culoriess Gasolane-like odor	6 2 6 3	6. FIRE HAZARDS Flash Point: 310°1 C C Flammable Limits in Air: 0.8° - 5.0°, Fire Extinguishing Agents: Foam, dry chemical, or carbon dovide	8. WATER POLLUTION 8.1 Aquetic Toxicity: Data and available 8.2 Waterfowl Toxicity: Data and available 8.3 Biological Oxygen Demand (BOD): Data and available 8.4 Food Chain Concentration Potential:
Call fire depa Avoid contac Isolate and re	t with liquid move discharged material health and pollution control ag		65 66 67	Fire Extinguishing Agents Not to be Used: Not perturent Special Hazards of Combustion Products: Not perturent Behavior in Fire: Not perturent Ignition Temperature: N40°1 (est.)	8 4 Pood Chair Concentration Potential:
Fire	Combustible Extinguish with foam, dry chemical or carbon dioxide Cool exposed containers with water  Fire			Electrical Hazard: Class L Group D Burning Rate: 4 mm mm	9. SELECTED MANUFACTURERS  1. Pennsylvania Retining Co-Builer, Par Tolkil 2. Sun Oil Co-Si-Davids, Par 19087  3. Union Oil Co-
Exposure	CALL FOR MEDICAL AID LIQUID Irritating to skin and eyes. Harmful if vosallowed. Remove contanunated cloth Flush affected areas with ple IF IN EYES, hold eyelish og IF SWALLOWED and victim or milk. DO NOT INDUCE VOMITI	ing and shoes enty of water sen and flush with plenty of water o a COMST DUS, have victim drink water	72 73 74	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not per	Antsco Division 3100 S. Meachem Rd Palatine, Hi. 6006
Water	Effect of low concentrations Fouling to shoreline May be dangeous if it enter	•	7 6	Inhibitor of Polymerization: Not pertinent	10. SHIPPING INFORMATION 10.1 Grades or Purity: Data not available 10.2 Storage Temperature: Ambient 10.3 Insert Atmosphere: No requirement 10.4 Venting: Open (flame arrester)
Pollution	Notify local health and wild Notify operators of nearby	life officials. water intakes.			
	ed	2. LABELS  No hazard label is required by Code of Federal Regulations		11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook CG 446-3) A-T-LJ	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Unund 13.2 Molecular Weight: Not pertinent 13.3 Boiling Point at 1 atm: 120.390°F = 100.199°C = 433.472°K 13.4 Prescing Point: Not pertinent
3.1 Synonyme: Drycl Petro Spott 3.2 Coest Querd Con	leum solvent ing naphtha apetibility Classification: rous hydrocarbon mixtures B: Not applicable done Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (se shipped): Liquid 4.2 Color: Colories 4.3 Odor: Like gasoline	12.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Combustible Liquid NAS Hazard Rating for Bulk Water Transportation: Not toted NFPA Hazard Glassifications: Category Classification Health Hazard (Blues 0 Flammability (Red) 2 Reactivity (Yellow) 0	13.5 Critical Temperature: Not pertunent 13.6 Critical Pressure: Not pertunent 13.7 Specific Gravity: 0.7k at 20°C (liquid) 13.8 Liquid Surface Tension: 19.23 dunes, cm = 0.019 0.023 × mar 20°C 13.9 Liquid-Water Interfacial Tension: 39-N dunes, cm = 0.039.003 N mar 20°C 13.10 Vapor (Gas) Specific Gravity: Data not available 13.11 Ratio of Specific Heats of Vapor (Gas): (cst. ) 1.09) 13.12 Listent Heat of Vaporization: 13.14 Sp Bit 0.5 T EN Cal. g
5.2 Symptoms Follow its wallowed, it 5.3 Treatment for Exp INGESTION SKIN wipe oil 5.4 Textelly by Inhele 5.5 Short-Term Inhele	re Equipment: Goggles or f. ing Exposure: High concen may get into lungs by aspirati osoure: INHAL ATTON rer do NOT induce somiting? Cal and wash with suap and wate tion (Threshold Limit Value ation Limits: 500 ppm for 36	tration of vapors may cause intoxication. If liquid on, not very irritating to skin or eyes move patient from exposure, freat symptoms. Bardwictor: EYES. Bush with water for 15 min. r. p. 22-200 ppm. min.			100-100 Bits   1-51 (-4)   2   3.04 × [10] / 1.52   4   10   1.52   10   10   10   10   10   10   10   1
5.7 Late Texicity: No		/kg are nontritating to the eyes and throat	_		Consinued on pages 5 and 6
5.9 Liquid or Solid fr	Mant Characteristics: Mini- use smarting and reddening of	mum hazard. If spilled on clothing and allowed to		NO	TES

OMN

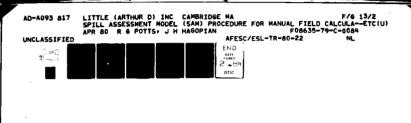
## OILS, MISCELLANEOUS: MINERAL

Common Synony Whate od Legual Petroletum Stop discher	Oily liquid Floats on water.	Coloriera Odos iesa	6.2 6.3	6. FIRE HAZARDS Flesh Polist: 380°F O C Flemmable Limits in Air: Data not available Fire Extinguishing Agents: Dry chemical, floam, or carbon divarde Fire Extinguishing Agents Not to be Used: Water or floam may cause fro	8. WATER POLLUTION 8.1 Aquatic Toxicity: Data not available 8.2 Waterfowt Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Data not available 8.4 Food Chain Concentration Potential: None
Call fire dept Avoid contac Isolate and re Notify local (	renove macrasized material. health and pollution control age		6.6 6.7	Special Hazards of Combustion Products: Not perturent Sehavior in First: Not perturent Ignition Temperatures: 980-700° F Electrical Hazards: Not perturent	N.C.
Fite	Combactible.  Extinguish with dry chemical, fuam or carbon dioxide.  Extinguish with dry chemical, fuam or carbon dioxide.  Water may be ineffective on fire.  Cool exposed containers with water.  CALL FOR WEDEAL AID.		Burning Rate: 4 mm, mm	9. SELECTED MANUFACTURERS  1. Shell Oil Co. 1. Shell Pluza Houston, Tex. 72001  2. Standard Oil Co. (Indiana) 410.5. Michigan Ave. Chicago, Illi (Midis)	
Exposure	LIQUID Ignitating to skin and cyes.	ty of water.  a right with plenty of water.  a right water water.	7.2 7.3 7.4	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stabile Neutralizing Agents for Acids and Caustics: Not pertinent	3 Sun Oil Co St. Davids, Pa. 19087
Water Pollution	Effect of low concentrations of Fouling to shoreline. Says to change to the control of the contr	rater intakes.		Polymerization: Not pertinent inhibitor of Polymerization: Not pertinent	10. SHIPPING INFORMATION 10.1 Grades or Purity: Commercial, refines 10.2 Storage Temperature: Ambient 10.3 Inert Almosphere: Surrequirement 10.4 Venting: Open (flame arrester)
See Response Metho Mechanical cont Should be remov		2. LABELS No hazard label required by Code of Federal Regulations		11. HAZARD ASSESSMENT CODE  1See Hazard Assessment Handbook CG 446-31  A:1-1:	13. PHYSICAL AND CHEMICAL PROPERT  13.1 Physical State at 15°C and 1 atm: 1 a  13.2 Molecular Weight: Not pertinent  13.3 Boiling Point at 1 atm: Very high  13.4 Freezing Point: Not pertinent  13.5 Critical Temperature: Not pertinent
Synonyme: I rque White Cosel Guard Con Miscellaneous h Chemical Formul IMCO United Nat Designation: 1 1	col npatibility Classification: ydrocarbon mixtures a: Not applicable floris Numerical 1270  5. HEALTH re Equipment: Congeter of la		12.2	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: Not Issed  NAS Hazard Rating for Bulk Water Transportation: Not Issed  NFPA Hazard Classifications: Category Classification  Health Hazard (Blac) 0 Flammability (Red) 1 Reactivity (Yellow) 0	13 6 Critical Pressure: Not pertinent  13 7 Specific Gravity: 0.822 at 20°C (liquid  13 8 Liquid Surface Tension:  27 dynes/cm = 0.027 N/m at 20°C  13 9 Liquid-Water Interfacial Tension:  47 dynes/cm = 0.047 N/m at 70°C  13 10 Vapor (Gas) Specific Gravity: Not pertinent  13 11 Ratio of Specific Heets of Vapor (Gas) And Specific Heets of Vapor (Gas) Not pertinent  13 12 Latent Heat of Vaporization: Not pertinent  13 13 Heet of Combustion: Data not available  13 14 Heat of Decomposition: Not pertinent  13 15 Heet of Solution: Not pertinent
Treatment for Exp Toxicity by Inhala Short-Term Inhala Toxicity by Ingesti Late Toxicity: No Vapor (Gae) Irrita	occure: EYES wash with wat tion (Threshold Limit Value) attor Limits: Not pertinent lens: Grade 1, EDe Sto ES g is no or Characteristics: None itent Characteristics: None	t Not pertinent			13 16 Heat of Polymerization: Not pertinent  13 16 Heat of Polymerization: Not pertinent  Community pages 5 and 6
				NO	TES

PCB

#### POLYCHLORINATED BIPHENYL

Common Synony Pt B Chlorasted hiphenyl Arochlor	Oily fiquid to solid Sinks in water	powder Light vellow liquid. Weak odor or white powder	6.2 6.3	6. FIRE HAZARDS Flash Point: >2xo*+ Flammable Limits in Air: Data not available Fire Extinguishing Agents: Warter, from drychemical or carbon dioxide Fire Extinguishing Agents Not to be Used:	8. WATER POLLUTION  8.1 Aquestic Toxicity:  0.278 ppm Web Hologoth 14 m. High water  0.408 ppm 346 (080 hr pontoh 14 m. salt water)  salt water  6.2 WaterCourt Toxicity: 1 D., 2000 ppm
Avord contact Call fire departs Isolate and re	e if possible. Keep people away i with liquid and solid (ment move discharged material realth and pollution control age	nces	66 67	Not pertinent Special Hazarda of Combustion Products: Irritating pases are generated in thes Behavior in Fire: Not pertinent Ignition Temporature: Data not available	Siological Oxygen Demand (BOD):     Version     4 Food Chain Concentration Potential:     High
Fire	Combustible Extinguish with water, foam,	ary chemical, or carbon dioxide		Electrical Hazard: Not perment Burning Refe: Data not available	9. SELECTED MANUFACTURERS Monsanto Industrial Chemicals Co. 800 Sorth Lindheigh Biod. St. Louis, Mo. 6306.
Exposure	CALL FOR MEDICAL AID LIQUID OR SOULD Irritating to skin and eyes Flush affected area, with plen It N. F.Y.F.S., hold evelids ope	nty of water en and thush with plenty of water	7 2 7 3 7 4 7 5	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent Polymerization: Not per	10. SHIPPING INFORMATION  10.1 Grades or Purity: 11 grades come liquid some collids which differ primarily in their chlorine content (20.68% by weight)
See Response Metho	May be dangerous if it enters Noristy local health and wildli Notify operators of nearby w TO DISCHARGE ds Mandbook CG 448-41 Mater confiammant ed	ife officials.		11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook CG 446 3)  II	10.3 Inert Atmosphere: No requirement 10.3 Inert Atmosphere: No requirement 10.4 Venting: Open  13. PHYSICAL AND CHEMICAL PROPERT 13.1 Physical State at 15°C and 1 atm: Noted or liquid 13.2 Molecular Weight: Not pertonent 13.3 Bolling Point at 1 atm: Vers high
3. CHEMICAL 3.1 Synonyms: Aroci hiphenst, Haloj Polychloropols	DESIGNATIONS or, Chlorinated cenated waxes, PC B. phenyls npatibility Cleanification:  C. (C.) Hinck K. Ix lions Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (an shipped): Liquid or solid 4.2 Color: Pale yellow (liquid), colorless colod 4.3 Odor: Practically odorless  Colori	12.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Not listed NAS Hazard Rating for Bulk Water Transportation: Not listed NFPA Hazard Classifications: Not listed	13.4 Freezing Point: Not pertinent 13.5 Critical Temperature: Not pertinent 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 1.3.1 × at 20.4 chique 13.8 Liquid Surface Tension: Not pertinent 13.9 Liquid-Water Interfacial Tension: Not pertinent 13.10 Vapor (Gas) Specific Gravity: Not pertinent 13.11 Ratio of Specific Heats of Vapor (Gas) Not pertinent 13.12 Latent Heat of Vaporization: Not pertinent
5 2 Symptoms Follow 5 3 Treatment for Ext 5 4 Toxicity by Inhals 5 5 Short-Term Inhal 5 6 Toxicity by Ingoes 5 7 Late Texicity tings 5 8 Vapor (Gas) Irrits 5 8 vapor (Gas) Irrits 6 9 and lung i	we Equipment: Gloves and judge Exposure: Acne from spoosure: Ski'N wash with so, iffice (Threshold Limit) Value at the state of Limit Value at the state of Limit Value at the state of Limit Value at LD50 uses chromosomal abnormal and Cheracheristics: Vapor njury. They cannot be tolera	kin contact ap and water <b>a):</b> O S to 3 O mg·m² ahle			13.13 Heat of Combustion: Not pertinent 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: Not pertinent 13.16 Heat of Polymerization: Not pertinent  (Continued on pages 5 and 6)
5 10 Oder Threshold:				NO	TIES



PGA

# PYROGALLIC ACID

Stop dis Call fire Isolate i	Solid  Sinka and mixes with solid and dust. Keep scharge if possible, department, and remove discharged material, local health and pollution control.	th water.	6.2 6.3 6.4 6.5	Schavior in Fire:	8. WATER POLLUTION 8.1 Aqueste Testelty: 18 ppm/48 hr/goldfish/TLm/fresh water 8.2 Weterfeet Testelty: Data not available 8.3 Biological Oxygen Germand (BOD): 1 6%, 5 days 8.4 Feed Chain Genoentration Petential: None
Fire	Combustible. Extinguish with water, dry ch	hemicals, foam, or carbon dioxide.	6.7 6.8 6.9	Electrical Hazard: Not pertinent	9. SELECTED MANUFACTURERS 1 The Harshaw Chemical Co. 1945 East 97 St. Cleveland, Ohio 4410b 2 Aldrich Chemical Co. 940 W. Saint Paul Ave. Milwauker, Wis. 53233
Exposure	If breathing has stopped, give if breathing a difficult, give of SOLID Instatung to skin and eyes. If swallowed will cause nauser Remove contaminated clothin Flush affected areas with pier IF IN EYES, hold eyepids our FSWALLOWED and victim or milk and have victim or milk and have victim IF SWALLOWED and victim GSWALLOWED and victim Jo nothing except keep	or difficult breathing, and flush with plenty of water. artificial respiration.  a. vomiting or loss of consciousness. ing and shoes. many of water. art of water. are not of water. It is CONSCIOUS, have victim drink water in LINCONSCIOUS, have victim drink water is LINCONSCIOUS OR HAVING CONVICTIM warm.	7.2 7.3 7.4 7.5 7.6 ULSIONS.	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materiale: Stability During Transport: Stuble Neutralizing Agents for Acida and Gaussics: Not pertinent Polymerization: Not pertinent Inhibitor of Polymerization: Not pertinent	J Eastman Organic Chemicals Rochester, N. Y. 14650  10. SHIPPING INFORMATION 10.1 Grades or Purity: N.F. Reagent 10.2 Storage Temperature: Ambient 10.3 Insert Atmosphere: No requirement 10.4 Venting: Open
See Response Me	Notify local health and wildle Notify operators of nearby will SE TO DISCHARGE immediates CO 464-41 water contaminant flush		rde of	11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook CG 446-3) SS	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Solid 13.2 Molecular Weight: 126 13.3 Boiling Point at 1 atm: SSE'F = 309°C = SSE''N 13.4 Prescring Point:
3.1 Synanyms: 1,2, Pyrogaliol: 1	2.3-Trihydroxybenzene ompetibility Clessification: rula: 1.2.3-C, H (OH). lations Numerical	4. OBSERVABLE CHARACTER 4.1 Physical State (as shipped): 4.2 Color: White to grav 4.3 Odor: None	ISTICS Solid 12.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Not listed NAS Hazard Rating for Bulk Water Transportation: Not listed NFPA Hazard Classifications: Category Classification Health Hazard (Blue)     Flammability (Red)     Reactivity (Yellow)   0	208" = 131" = 404"K  13.5 Critical Temperature: Not pertinent  13.6 Critical Temperature: Not pertinent  13.7 Specific Gravity: 1.45 at 20°C (solid)  13.8 Liquid Surface Tension: Not pertinent  13.9 Liquid-Water Interfacial Tension: Not pertinent  13.10 Yapor (Gas) Specific Gravity: Not pertinent  13.11 Ratio of Specific Heals of Vapor (Gas): Not pertinent
5 2 Symptoms Folk Intestion man Jeath C Intac several, and d 5 3 Treatment for E impount of Wa at least 15 mit physician of et 7 Toxicity by Inne 5 5 Short-Term Inhi 5 6 Toxicity by Inge 5 7 Late Toxicity: L	citive Equipment: Runher clove pring Exposure: Innalation of vicause severe gastrointestinal in a with even causes infrastion. San death, repeated contact can cause sponure: INHAL VIION rem ter; induce symiting immediately	f dust causes critication of nose and throat ritiation convolvions, circulatory collapse in contact can cause local discoloration, if exensitization. INGESTION of two consult a physician EMESTION of two consult a physician EMESTION with each immediately with soup and water con- ply. Data not available the point available.	ritation, veiturge vater for	NO	13 12 Latent Heet of Vaporization: Not perturent 13 13 Neet of Combustien: -4 130 Btu 16 w -5,010 cat; g = -212 × 10°3 kg 13.14 Heet of Decomposition: Not perturent 13.15 Heet of Solution: Not perturent 13.16 Heet of Polymorization: Not perturent Continued on popen 1 and 6.

5 10 Oder Threshold: 0 17 ppm

#### **TOLUENE**

6. FIRE HAZARDS 8. WATER POLLUTION 8.1 Aquatic Texicity: 1180 mg 1,596 hr sunlish 11 m (resh water 6.2 Fiammable Limits in Air: 1.27% 1% 8.2 Waterlowi Texicity: Data not available 6.3 Fire Extinguishing Agents: Carbon doxide or dry chemical for small fires ordinary foam for large fires Floats on water. Flammable, arritating vapor is produced 8.3 Biological Oxygen Demand (BOD): (ir. 5 days, 38's (theor ) 8 days Stop discharge if possible. Keep geople away, Shut off fignition vortices and call fire department. Stay uppind and ties water spays to "knock down" sapor Voud contact with fujud and sapor holder and remove discharged material. Notify fixed health and pollution control agencies. Fire Extinguishing Agents Not to be Used: Water may be ineffective 8.4 Food Chain Concentration Poli Special Hazards of Comb Not pertinent Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and FLAMMABLE.
Plashback along vapor trail may occur.
Vapor may explude if ignited in an enclused area flash back 9. SELECTED MANUFACTURERS Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide Water may be ineffective on fire. Coul exposed containers with water Exxon Chemical Co Houston Tex 77001 6.8 Electrical Hazard: Class I. Group D. Fire 6.9 Burning Rate: > 7 mm mm Shell Chemical Co. Houston Lex 77001 Sun Oil Co St. Davids Pa. 19087 CALL FOR MEDICAL AID VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizzinem, difficult breathing, or loss of consciousnem. 7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen. No reaction Stability During Transport: Stable Neutralizing Agents for Acids and Caustics: Not pertinent LIOUID Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness. Exposure Polymerization: Not pertinent Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
If IN EVES, hold evelids open and flush with plenty of water.
IF SWALLOWED and section is CONSCIOUS, have victim drink water. 10. SHIPPING INFORMATION 10.1 Grades or Purity: Research, reagent intration all 99 84%, industrial contains 944%, with 5% xylene and small or milk. DO NOT INDUCE VOMETENG. amounts of benzene and nunarom sta hydrocarbons, 90-120-less pure than industrial Dangerous to aquatic life in high concentrations. Fouling to shoreline.

May be dangerous if it enters water intakes. 10.2 Storage Temperature: Ambient Water 10.3 Inert Atmosphere: No requirement **Pollution** Notify local health and wildlife officials. Notify operators of nearby water intakes 10.4 Venting: Open thame arresters or pressure-vacuum 2. LABEL 1. RESPONSE TO DISCHARGE 11. HAZARD ASSESSMENT CODE 13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Liquid (See Response Methods Handbook, CG 446-4) neni Handhoos CG 446-3) 13.2 Molecular Weight: 92 14 Issue warning high flammability A-T-t 13 3 Boiling Point at 1 atm: 231 1°E = 110 6°C = 383 8°K 13.4 Freezing Point: -139°1 = -95 0°C = 178 2°K 12. HAZARD CLASSIFICATIONS Critical Temperature: 605.4°E = 318.6°C = 591.8° K 12.1 Code of Federal Regulations: 4. OBSERVABLE CHARACTERISTICS 3. CHEMICAL DESIGNATIONS I lammable liquid 13.6 Critical Pressure: Physical State (as shipped): Liquid 3.1 Synonyme: Methylhenzene NAS Hazard Rating for Bulk Water 596.1 psia = 40.55 atm = 4 108 MN/m<sup>2</sup> Methylbenzol 4.2 Color: Colorless 13.7 Specific Gravity: 0 867 at 20°C (liquid) 4.3 Odor: Pungent; aromatic, benzene-like, distinct, pleasant Category Reting 3.2 Coast Guard Compatibility Classification: Aromatic hydrocarbon 13.8 Liquid Surface Tension: tire 29.0 dynes cm = 0.0290 N m at 20°C Health 3.3 Chemical Formula: C.H.C.H. 13.9 Liquid-Water Interfacial Tension: Vapor trotani 36 I dynes cm # 0.0361 N m at 25°C 3.4 IMCO/United Nations Numerical Designation: 3.2:1294 Liquid or Solid Irritant Poisons 13.10 Vapor (Gas) Specific Gravity: Not pertinent Water Pollution 13.11 Ratio of Specific Heats of Vepor (Gas): Human Toxicity Aquatic Loxicity 5. HEALTH HAZARDS Aesthetic I ffect 13.12 Letent Heat of Vaporiz rennel Protective Schill ont: Air-supplied mask, goggles or face shield, plastic gloves 155 Big th = 86 f cally = 3.61 × 105 f kg Reactivity 5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract, cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If 13.13 Heat of Combustion: -17,430 Btu th = -9686 call g = -405 5 × 10° J kg Other Chemicals Water Self-Reaction 13.14 Heat of Decomposition: Not pertinent ingested causes comiting, griping, diarrhea, depressed respiration NFPA Hazard Classif 13.15 Heat of Solution: Not pertinent ngestroad for Exposure: 18HALATION remove to fresh air, give artificial respiration and oxygen if needed, call a doctor 18GESTION do NOT induce conting, call a doctor 18GESTION do NOT induce conting, call a doctor 18GESTION do NOT induce conting, call a doctor 18GESTION wipe off, wash with stap and water. Category 13.16 Heat of Polymerization: Not pertinent Health Hazard (Blue) 5.4 Taxicity by Inhelation (Threshold Limit Value): 100 ppm Reactivity (Yellow) 5.5 Short-Term Inhelation Limits: 6(II) opm for 30 min 5.6 Toxicity by Ingestion: Grade 2.1 De 0.5 to 5 g/kg Continued on pages 5 and 6 5.7 Late Toxicity: Kidnes and liver damage may follow ingestion 5.8 Vapor (Qos) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory NOTES system if present in high concentrations. The effect is temporars 5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.

REVISED 1976

## **TRICHLOROETHYLENE**

Common Synon Trickloraethrae Trickne	Watery is	quid	Colories	Sweet odor
	Sinks in	water. Irritating	rapor is produced.	
Avoid contac	e if possible. Keep pe I with liquid and vapo	opie away. or.		
Call fire depa Isolate and re Notify local I	rement. move discharged mate ealth and pollution c	ertal ontrol agencies		
	•	•		
	Combustible: POISONOUS GAS	ES ARE PRODU	CED IN SIDE	
	Wear goggles and se Extinguish with dry	If contained brea	thing apparatus.	
Fire				
				-
	CALL FOR MEDIC VAPOR			
	Irritating to eyes, n If inhaled, will cause or loss of con-	e neumes, vomiti	ng, difficult breathing,	
	Move to fresh air. If breathing has sto	pped, give artific	ial respiration.	
_	If breathing is diffic LIQUID Irritating to skin ar			
Exposure	If swallowed, will o or loss of cons	ause nauses, von Iciousness.	siting, difficult breathin	<b>6</b> ,
	Remove contamina Flush affected area IE IN EVES hold a	s with plenty of	na ler	•
	IF SWALLOWED a	and victim is CON	flush with plenty of wa iSCIOUS, have victim d vomiting. CONSCIOUS OR HAVI	rink water
,	VULSIONS, d	na victim is UNG to nothing excep	ONSCIOUS OR HAVE keep victim warm	NG CON-
Water	Effect of low conce			
	May be dangerous i	f it enters water		
Pollution	May be dangerous i Notify local health Notify operators of	f it enters water and wildlife offic	intakes. :ials.	
	May be dangerous i Notify local health	f it enters water and wildlife offic	intakes. :ials.	
Pollution	May be dangerous i Notify local health Notify operators of	f it enters water and wildlife offic	intakes. ials. takes.	
Pollution  1. RESPONSE	May be dangerous i Notify local health	f it enters water and wildlife offic	intakes. ials. takes.	BELS
Pollution  1. RESPONSE	May be dangerous in Notify local health Notify operators of TO DISCHARGE to Mandbook. CG 446-4) and CG 446-4)	f it enters water and wildlife offic	intakes. rials. akes.  2. L/I	BELS bel required by rail Regulations
1. RESPONSE (See Response Methol Should be removed)	May be dangerous in Notify local health Notify operators of TO DISCHARGE to Mandbook. CG 446-4) and CG 446-4)	f it enters water and wildlife offic	intakes. rials. akes.  2. L/I	bel required by
1. RESPONSE (See Response Methol Should be removed)	May be dangerous in Notify local health Notify operators of TO DISCHARGE to Mandbook. CG 446-4) and CG 446-4)	f it enters water and wildlife offic	intakes. rials. akes.  2. L/I	bel required by
1. RESPONSE (See Response Metho Should be remus C hemic, al and ph	May be chargerous in Notify local health Notify operators of TO DISCHARGE on Mandagood CG 446-4) ed Syncial treatment DESIGNATIONS	f it enlers water and wildlife en nearby water in	2. Li No hazard lai C ode of Fede	bel required by rail Regulations
1. RESPONSE (See Response Metho Should be remin C hemical and ph  3. CHEMICAL 1 Synonyma: Algs) Gennalgene, Th	May be chargerous in Notify local health Notify operators of TO DISCHARGE on MANDROOK CG 446-4) ed systeal treatment DESIGNATIONS en. C hiorylen.	f it enters water and widdlic offin nearby water in	2. Li No hazard lai C ode of Fede	bel required by rail Regulations
1. RESPONSE (See Response Methology of the Chemical and phonomic Algy) Gernalgene. The Tre, Treshoran.	May be chargerous in Notify local health Notify operators of TO DISCHARGE on NANDOON CG 444-4) cd which it realment DESIGNATIONS en. ( hlorylen.	f it enters water and widdlic for nearby water in	A. OBSERVABLE ( Physical State (se	bel required by rail Regulations  CHARACTERISTICS  Shipped): Liquid
1. RESPONSE (See Response Methology of the Chemical and phonomic Algy) Gernalgene. The Tre, Treshoran.	May be chaptrous in Notify local health Notify operators of DISCHARGE on Mandacook CG 446-4) ed posted treatment DESIGNATIONS on, Chlorylen, etchylen, Trebhorochben, Ir Trichnochten, Ir Trichno	f it enters water and widdlic for incarby water in the control of	2. Li No hazard lai Code of Fede  4. OBSERVABLE ( Physical State (as. Color: Culorless	bel required by rail Regulations  CHARACTERISTICS  Shipped): Liquid
1. RESPONSE (See Response Memo Should be remo; C hemical and ph  3. CHEMICAL 1. Synonyma: Algo) Gemalgene: Th 17. Troshoran, Clene, Trielene. 2. Coost Guard Com Halogenated h 3. Chemical Formula	May be chargerous in Notify local health Notify operators of TO DISCHARGE on MANDROW CG 444-4) ed color of the Color of th	f it enters water and widdlic for incarby water in the control of	2. Li No hazard lai Code of Fede  4. OBSERVABLE ( Physical State (as. Color: Culorless	bel required by rail Regulations  CHARACTERISTICS  Shipped): Liquid
1. RESPONSE (See Response Metho Should be remore Chemical and ph  3. CHEMICAL Synonyms: Algyl Gemalgene: Ih Irs, Trashoran, Clene, Trielene Coost Quard Com Halogenated h	Nay be chargerous in Notify local health Notify operators of DISCHARGE on MANDROOK CG 446-4) ed systeal treatment DESIGNATIONS en. C hiorylen, etchylen, Treshirochtene, Ir Trushen, Erful Erdene, Ir Languettbility Classific ydrocarbon B. C HC C C) toon Numerical Notific Control Numerical	f it enters water and widdlic for incarby water in the control of	2. Li No hazard lai Code of Fede  4. OBSERVABLE ( Physical State (as. Color: Culorless	bel required by rail Regulations  CHARACTERISTICS  Shipped): Liquid
3. CHEMICAL Synonyma: Algyl Gemalgene. Th Ire, Trichloran, Clem. Lirelene Coest Guard Com Halogenated h Chemical Formul MCO/United Nat	May be designous under Notify local health Notify operators of DISCHARGE on Mandbook CG 446-4) ed Systeal treatment DESIGNATIONS en. C. hivrylen, etchylen, Treshiorechtene, Ir Trulene, I ritine, I	f it enters water and wildlife offinearby water in 4.1 4.2 4.3 ation:	2. Li No hazard lai C ode of Fede  4. OBSERVABLE ( Physical State (as Color: Culorless Odor: Chloroform-	bel required by rail Regulations  CHARACTERISTICS  Shipped): Liquid
1. RESPONSE (See Response Method Should be remus Chemical and ph  3. CHEMICAL 1. Synonyma: Algyl Gemalgene: Th Tri, Trichloran, Clene: Trichloran, Clene: Trichloran Clene: Tr	Nay be chargerous in Notify local health Notify operators of DISCHARGE on MANDROOK CG 446-4) ed systeal treatment DESIGNATIONS en. C hiorylen, etchylen, Treshirorethene, Ir Trushen, Erful France, Erful France, Erful France, Ir Trushene, Ir	f it enters water and wildlife offinearby water in 4.1 4.2 4.3 ation:	2. Li No hazard lai C ode of Fede  4. OBSERVABLE ( Physical State (as: Color: Culorless Odor: Chloroform-	bel required by rail Regulations  CHARACTERISTICS shipped): I rquid like, ethereal
1. RESPONSE (See Response Memo Should be remus Chemical and ph  3. CHEMICAL 1. Synonyma: Algol Gemalgene, Th Iri, Iris hloran Clene, Irielene; 2. Coost Guard Core Halogenated h 3. Chemical Formul 4. IMCO/United Nat Designation: 9.0/	Nay be chaptrous in Notify local health Notify operators of DISCHARGE on Hundbook CG 444-4) ed Sysical Irrealment Section 1998. Children 1998	f it enters water and wildlife offinearby water in 4.1 4.2 4.3 ation:	2. Lift No hazard fall Code of Fede  4. OBSERVABLE ( Physical State (as Color: Cutorless Odor: Chloroform-  ROS   gas canister, self-cont chemical safety goggliash protections.	bed required by trail Regulations  CHARACTERISTICS shipped): I rquid like, ethereal  ained breathing es, lace-shield.
1. RESPONSE (See Response Memo Should be remos C hemical and ph  3. CHEMICAL 1. Synonyma: Algy) Gemalgene, Th Ire, Troshoran, Clene, Trielene, Coost Guard Com Halogenated h 3. Chemical Formul 4. IMCO/United Net Designation: 9.0/	Nay be disgress at Notify local health Notify operators of DISCHARGE on Mandeook CG 444-4) ed systeal treatment DESIGNATIONS on, Chlorylen, ethylene, Treshylene, Treshylene, Trushylene,	fit enters water and wildlife offinearby water in 4.1 4.2 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3	AROS  AROS  Coder: Chloroform-  AROS   characteristics  characteristics  characteristics  chipped): I iquid  like, ethereal  ained breathing  cs. lace-shield.  retation of the nove  illy disturbance of	
1. RESPONSE (see Response Memo Should be remov C hemical and ph  3. CHEMICAL Synonyma: Algyl Gemalgene, Th Iri, Trashoran, Clene, Triclene, Coost Guard Common Halogenated b MCO/United Nat Designation: 9.0/ 1 Porsonal Protects apparatus for en apparatus for en coprene safely Emphane Follow and throat to na central nervous ENGESTION	Nay be disagrous in Notify local health Notify operators of DISCHARGE on MANDROW CG 444-4) ed systeal treatment DESIGNATIONS en. Chlorylen. Erchlorocthene. Fr Irichlorocthene. Fr Irichlene. Irichly Clinoch Numerical 1710  5. The Company of the Co	### ##################################	A. OBSERVABLE ( Physical State (as Codor: Culoriorm-  AROS ( Grand State	characteristics shipped): I iquid like, ethereal ained breathing es, lace-shield, renation of the noc slig disturbance of assess organic injury
1. RESPONSE (See Response Metho Should be remus Chemical and ph  3. CHEMICAL Synonyma: Algol Gemalgene: Th Iri, Troshoran, Clene, Triclene Coost Guard Corr Halogenated h  3. Chemical Formula I IMCO/Unided Nat Designation: 90,  1. Personal Protecti apparatus for e neoprene safety Apparatus for e neoprene safety Symphome Follow and throat to an central nervous INGESTION FYES sight', Treatment for E.g.	TO DISCHARGE OF MANDROSE CONTROL HEATH NOUTY OPERATORS OF MANDROSE CONTROL  DESIGNATIONS OF MANDROSE CONTROL  DESIGNATIONS OF MANDROSE CONTROL  DESIGNATIONS OF MANDROSE CONTROL  DESIGNATIONS OF MANDROSE CONTROL  TECHNOLOGIC  T	### ##################################	A. OBSERVABLE (  Ode of Fede  4. OBSERVABLE (  Physical State (as: Color: Culorless Odor: Chloroform-  NROS  gas canster, self-cont chemical safety goggl lash protection of promise range from in hurred vision, and fin. or epinephrine; get	characteristics shipped): I iquid like, ethereal ained breathing es, lace-shield, retation of the nove illy disturbance of anaco organic injury in cause dermatitis medical attention
1. RESPONSE  1. RESPONSE (See Response Methology of the Persponse Persponse Persponse National Protection of the Persponse Persponse National Persponse National Persponse National Persponse National Persponse National Persponse Persponse National Persponse National Persponse Persponse National Persponse Persponse National	TO DISCHARGE ON MANDROW CG 444-4) ed systeal treatment  DESIGNATIONS en, Chlorylen, ethylen, Trebylen, Tre	HEALTH HAZI ation:  HEALTH HAZI ation:  HEALTH HAZI anne vapor-acte or vinyl gloves or apron for vp HALAFION v rresponsibility, rresponsibility, or apron failure ( inhalation SM indiachry matto Jminister adrens I VTION rem in VIION rem in VIION rem in cer ovygen 1500	A. OBSERVABLE (  A. OBSERVABLE (  Physical State (  Color: Culorless  Odor: Chloroform-  Color: Culorless  Odor: Chloroform-  IROS  gas canister, self-cont chemical safety goggl ash protection improme range from in hurred vision, and fina home exposure may on defatting action can alin or epinephrine; get ove victim to fresh air; its TION have victim	characteristics shipped): I quid like, ethereal ained breathing es, lace-shield, ritation of the nove illy disturbance of anaco organic injury in cause dermatitis medical attention if necessary, apply distins water and
3. CHEMICAL  3. CHEMICAL  3. CHEMICAL  3. CHEMICAL  3. CHEMICAL  3. CHEMICAL  4. Interpretation  5. Const Quard Con- Halogenated h  6. Const Quard Con- Halogenated h  7. Interpretation  6. Const Quard Con- Halogenated Portusal  6. Interpretation  7. Const Quard Con- Halogenated Portusal  8. Interpretation  9. Open Constitution  1. Personal Protects  1. Apparatus for example of the con- 1. Apparatus for example of t	TO DISCHARGE  SHAPPER STATEMENT STAT	MEALTH HAZE mat  MEALTH HAZE mat  ALS  Or viny gloves or apron for ye rresponsibility, ardiac failure ( inhalation 5kl ind lackrymaton it villon remiter ovygen 15v6 then give 1 table	AROS	characteristics shipped): I iquid like, ethereal ained breathing es, face-shield, ritiation of the nose ally disturbance of rause organic injury is cause demantity medical attention if necessary, apply dinth water and
1. RESPONSE (SEE RESPONSE (SEE RESPONSE DEMONS (SEE RESPONSE MEMONS AND	TO DISCHARGE ON MANDOON CG 446-4) ed systeal treatment  DESIGNATIONS on Chlorylen, ethylen Chlorylen, ethylen, Erchylen, Erchy	HEALTH HAZI and wildlife offi nearby water in  4.1  4.2  1.  4.3  ation:  HEALTH HAZI game vapor-acte or vinyl gloves or apron for vp HALA FION v, rresponsibility, or apron for vp HALA FION then give it table the rows gen 150 then give 1 table ther ovy gen 150 then give 1 table wash throughly mit Value): 100	A. OBSERVABLE (  Ode of Fede  4. OBSERVABLE (  Physical State (as  Color: Cutorless  Odor: Chloroform-  Alloss  Alloss  Alloss  Alloss  Odor: Chloroform-  Alloss  All	characteristics shipped): I iquid like, ethereal ained breathing es, face-shield, ritiation of the nose ally disturbance of rause organic injury is cause demantity medical attention if necessary, apply dinth water and
1. RESPONSE (See Response Memo Should be remore Chemical and ph  3. CHEMICAL Synonyms: Algyl Gemalgene: Ih Iri, Trishioran, Clene, Trielene Coest Quard Con Halogenated h  IMCO/United Net Designation: 90/ Personal Protect apparatus for et artificial revious INCESTION FYES slight; Treatment for Et g for all cases (id artificial res or induce vom ting flush the suight Tesiteting by Inhale Short-Torm Inhal	Notify local health Notify operators of Notify operators of DISCHARGE on Mandacon CG 444-4; ed systeal treatment Series of Mandacon CG 444-4; ed systeal treatment Triching trium, and the CG for the Mandacon CG 444-4; ed for the Mandaoon CG 444-4; ed for the Mandaoon CG 444-4;	HEALTH HAZI salion:  HEALTH HAZI salion:  HEALTH HAZI ation:  HEALTH HAZI salion:  HEALTH HAZI salion:  HEALTH HAZI salion:  LATION - car ardiac failure in a pron for sp HALLATION - car tres-ponsibility, ardiac failure in salion:  LATION rem in salion:  LATION rem in salion:  LATION rem in salion:  LATION rem in salion:  LATION can in salion:	A. OBSERVABLE ( Ode of Fede  4. OBSERVABLE ( Physical State (as. Color: Culories Odor: Chloroform-  AROS  Jas canster, self-cont chemical safety goggl lash protection improms range from in hurred vision, and fin. in or epinephrine; get ove victim to fresh air; repion epsom salts in as y with viap and warin ppion epsom salts in as y with viap and warin ppion	characteristics shipped): I iquid like, ethereal ained breathing es, face-shield, ritiation of the nose ally disturbance of rause organic injury is cause demantity medical attention if necessary, apply dinth water and
1. RESPONSE  1. RESPONSE (See Response Methological Should be removed the Chemical and philogenation of the Chemical and philogenation of the Chemical Formation of the Chemic	TO DISCHARGE ON THANDOOK CG 444-4) ed Strick Iteration of the Control of the Cont	### ##################################	A. OBSERVABLE ( Ode of Fede  4. OBSERVABLE ( Physical State (as. Color: Culories Odor: Chloroform-  AROS  Jas canster, self-cont chemical safety goggl lash protection improms range from in hurred vision, and fin. in or epinephrine; get ove victim to fresh air; repion epsom salts in as y with viap and warin ppion epsom salts in as y with viap and warin ppion	characteristics shipped): I iquid like, ethercal ained breathing se, Jace-sheld. Aritation of the nose illy disturbance of ause organic injury in cause dermatitis medical attention if necessary, apply diship water and water 1 Y L S, water

3.1 P	6. FIRE HAZARDS  lash Point: 90°1 C ( , practically	8. WATER POLLUTION 8.1 Aquatic Texicity:
٠.	nonflainmable	6.1 Aquatic Foliatory: 660 mg, 1,340 hr/daphnia/ kitt, fresh water
2 F	lemmable Limite in Air: ×0° - 10 %	8.2 Waterloud Toxicity: Data not available
3 F	ire Extinguishing Agents: Water log	8 3 Biological Oxygen Demand (BOD):
	ire Extinguishing Agents Not to be U	Data not available
	Not pertinent	8 4 Food Chain Concentration Patential:
5 \$	pecial Hezards of Combustion Produ	
	Toxic and irritating gases are produce in fire situations	1
6	chavior in First: Not pertinent	
	inition Temperature: 770 °1	
	lectrical Hazard: Not pertinent	
	urning Rate: Not persinent	9. SELECTED MANUFACTURERS
-		1 Dow Chemical Co
		Midfand, Mich 48640
		2 1 1 duPont de Nemaurs & Co. Inc.
		Hectrochemicals Dept
		Wilmington Del 19898
		3 PPG Industries Inc Industrial Chemical Division
	7. CHEMICAL REACTIVITY	Lake Charles La 70601
1 R	enctivity with Water: No reaction	
	eactivity with Common Materials:	
-	No reaction	
3 8	tability During Transport: Stable	
	eutralizing Agents for Acids and	
	austics: Not pertinent	
-	olymerization: Not pertinent	
6 H	hibitor of Polymerization: Not pertur	10. SHIPPING INFORMATION
		10.1 Grades or Purity: Technical dec
		cleaning degreating extraction
		10.2 Storage Temperature: Ambient
		10.3 Inert Atmosphere: No requirement
		10.4 Vonting: Pressure sacuum
		10.4 Venting: Pressure vacuum
	11 HAZARD ASSESSMENT CODE	
	11. HAZARD ASSESSMENT CODE	13. PHYSICAL AND CHEMICAL PROPERTIE
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIE
		13. PHYSICAL AND CHEMICAL PROPERTIE 13.1 Physical State at 15°C and 1 atm: Liqui 13.2 Molecular Weight: 131.19
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIE
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 15°C and 1 atm: Liqui  13.2 Molecular Weight: 131 No.  13.3 Beilling Point at 1 atm: Livi's 1871 = 87°C = 164°S.  13.4 Freezing Point:
	(See Hazard Assessment Handbook, CG 446-3)	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 15°C and 1 atm: Liqu  13.2 Molecular Weight: 13.10  13.3 Boiling Point at 1 atm:  1891 = \$77C = \$160 K.  13.4 Pressing Point:
	12. HAZARD CLASSIFICATIONS	13. PHYSICAL AND CHEMICAL PROPERTIE     13.1 Physical State at 15°C and 1 atm: 1 qui     13.2 Molecular Weight: 13.19     13.3 Belling Point at 1 atm:     134°E = 37°C = 166°K     13.4 Pressing Point:     123.5°F = ∞ 6.4°C ≈ 166 K K     13.5 Critical Temperature: Not pertucut
	1.5ee Hazard Assessment Handbook CG 446 3) A-X-Y  12. HAZARD CLASSIFICATIONS code of Federal Regulations: ORM A	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: 1 ag  13.2 Molecular Weight: 13.1 b  13.3 Boiling Point at 1 atm: 18975 = 877C = 1647 K  13.4 Pressing Point: -12.1 VI = 786.4 C = 166.8 K  13.5 Critical Pressure: Not pertinent  13.6 Critical Pressure: Not pertinent
.2	ISee Hazard Assessment Handbook CG 446 3)  A-X-Y  12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A  148 Hazard Rating for Bulk Water	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 15°C and 1 atm: 1 age  13.2 Molecular Weight: 13: 19  13.3 Solding Point at 1 atm: 1 age 1
.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A 4.8 HAZARD Rating for Bulk Water Transportation:	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 15°C and 1 atm: 1 au  13.2 Molecular Weight: 13.19  13.3 Beiling Point at 1 atm: 130°1 = 37°C = 166°K  13.4 Pressing Point: 123.0°1 = > m4.4°C = 166°K  13.5 Critical Temperature: Not pertinent 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 1.4 au 20°C (highd) 13.8 Liquid Surface Temperature
.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: CRM A. A. Hazard Rating for Bulk Water Transportation: Category Rei	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: 1 iqu  13.2 Molecular Weight: 13.19  13.3 Boiling Policit: 13.19  13.4 Pressing Policit: -123.5°1 = +66.4°C = (bit b. b.  13.5 Critical Pressure: Not pertinent  13.6 Critical Pressure: Not pertinent  13.7 Specific Gravity: 1.46 at 30.0 C (hquidit)  13.8 Liquid Surface Tevelent: 29.14 bits cm = 0.023 N. mat 20°C
.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A 148-Hazard Rating for Bulk Water Transportation: Category Ret	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 15°C and 1 atm: 1 agu  13.2 Molecular Weight: 13: 19  13.3 Boiling Point at 1 atm: 1 agu  13.4 Freezing Point: -121.5°C - 166.5°C  13.5 Critical Temperature: Not pertinent  13.6 Critical Temperature: Not pertinent  13.7 Specific Gravity: 1 46 at 20°C (figuid)  13.8 Liquid Surface Tension: 29.1 dans. cm = 0.093.5°C m at 20°C  13.9 Liquid-Water Interfacial Tension:
2.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A NAS Hazard Rating for Bulk Water Transportation: Category Rati Health	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: 1 iqu  13.2 Molecular Weight: 13.19  13.3 Boiling Policit: 13.19  13.4 Pressing Policit: -123.5°1 = +66.4°C = (bit b. b.  13.5 Critical Pressure: Not pertinent  13.6 Critical Pressure: Not pertinent  13.7 Specific Gravity: 1.46 at 30.0 C (hquidit)  13.8 Liquid Surface Tevelent: 29.14 bits cm = 0.023 N. mat 20°C
.2	12. HAZARD CLASSIFICATIONS  Code of Federal Regulations: ORM A  1AS Hazard Rating for Bulk Water Transportation: Category Ret Hire I Health Vapor Irritant Liquid cvolid Irritant I I Iquid volid Irritant	13. PHYSICAL AND CHEMICAL PROPERTIE   13.1   Physical State at 15°C and 1 atm: 1 rul   13.2   Molecular Weight: 13: 10   13.3   Beiling Point at 1 atm:   130°1 = 37°C = 166°K     14.   Pressing Point:   123.0°1 = = 56.4°C = 156.6°K     13.5   Critical Temperature: Not perturent   13.6   Critical Temperature: Not perturent   13.7   Specific Gravity: 1.4 at 20°C c (dual)   13.8   Liquid Surface Temperature   29.1 dans.; cm = 0.033°K   m.at 20°C     13.9   Liquid-Water Interfacial Temperature   13.4.5 dyns/cm = 0.0345°K/m at 24°C
.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A NAS Hazard Reting for Bulk Weter Transportation: Category Reti Ling I Linguid or Noted Irritant I Linguid or Noted Irritant I Possons 2	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: Equ  13.2 Boiling Point at 1 atm: 13.3 Boiling Point at 1 atm: 13.4 Pressing Point: 13.4 Pressing Point: 13.5 Critical Pressure: Not pertinent 13.6 Critical Pressure: Not pertinent 13.7 Specific Gravity: 14-at 20 C (Injurid: 13.8 Liquid Surface Tension: 29 1 days cm = 0.024 N mat 20°C 13.9 Liquid-Water Interfacial Tension: 14.5 dynac/cm = 0.034 N/m at 24°C 13.10 Vapor (Gae) Specific Gravity: 4 S
2.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A 4A8 Hazard Rating for Bulk Weter Transportation: Category Ret Heath Vapor Irriant I Liquid or Solid Irriant I Poisons 2 Water Pollution	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: Figure 13.2 Molecular Weight: Fix 13.4 Molecular Weight: Fix 13.4 Molecular Weight: Fix 13.4 Pressing Point:  13.4 Pressing Point:  13.5 Critical Pressure: Not pertinent  13.6 Critical Pressure: Not pertinent  13.7 Specific Gravity: 14 at 3.0 C (hyund)  13.8 Liquid Surface Tevelent:  29 Nanas on = 0.043 N mat 20°C  13.9 Liquid-Weiter Interfacial Tension:  34.5 dynes/cm = 0.0345 N/m at 24°C  13.10 Vapor (Gae) Specific Gravity: 4 N  13.11 Ratio of Specific Heats of Vapor (Gae):  1.116  13.12 Letent Heat of Vaporization:
.2	12. HAZARD CLASSIFICATIONS  12. HAZARD CLASSIFICATIONS  13. HAZARD CLASSIFICATIONS  14. HAZARD CLASSIFICATIONS  15. HAZARD CLASSIFICATIONS  15. HAZARD CLASSIFICATIONS  16. HAZARD CLASSIFICATIONS  16. HAZARD CLASSIFICATIONS  17. HAZARD CLASSIFICATIONS  18. HAZARD CLASSIFICATIONS  19. HAZARD CLASSIFICATIONS  19	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: 1 au  13.2 Molecular Weight: 13.19  13.3 Beiling Point at 1 atm: 1 au  13.4 Pressing Point: -12.14 (x 1 km k k  13.5 Critical Pressure: Not pertinent  13.6 Critical Pressure: Not pertinent  13.7 Specific Gravity: 1.46 at 20 C (hund)  13.8 Liquid Surface Tension: 29 1 dans cm = 0.024 N m at 20°C  13.9 Liquid-Water Interfacial Tension: 34.5 dynes/cm = 0.0348 N/m at 24°C  13.10 Vapor (Gae) Specific Gravity: 4 S  13.11 Ratio of Specific Heats of Vapor (Gae): 1.116  13.12 Letent Neet of Vaporization: 103 Blu/lb = 57.2 cut y = 2.40 × 10° E-1
.2	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: ORM A 4A8 Hazard Rating for Bulk Weter Transportation: Category Ret Heath Vapor Irriant I Liquid or Solid Irriant I Poisons 2 Water Pollution	13. PHYSICAL AND CHEMICAL PROPERTIE  13.1 Physical State at 18°C and 1 atm: Engl 13.2 Molecular Weight: 13.19  13.3 Boiling Point: 13.19  13.4 Pressing Point: 183 ** ** ** ** ** ** ** ** ** ** ** ** **

NOTES

# UREA

Common Synonym Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule Carbonyldasmule	Solid crystab or pellets Sinks and mixes with w. Insent nove decharged maternal catth and pollution control agencies		62 63 64 65 66 67 68	6. FIRE HAZARDS Flook Point: Not fluored to Flook Point: Not fluored to Fire Extinguishing Agents: Water Fire Extinguishing Agents Not to be Used: Not pertical Special Hazards of Combustion Products: Not pertical Behavior in Fire: Will and decomposing your amountment Ligition Temporature: Not fluored to Electrical Hazard: Not permical	8. WATER POLLUTION 8.1 Aquatic Toxicity:  Wellering 1: "A feet receivable all deed to the house in the all deed to the house in the ho
Fire	Extanguish with water			Burning Rate: Not tlanmable	9. SELECTED MANUFACTURERS 1. Afficial Concessor Congression of Testington Manufaction (N. 1 (2004)) 2. Lone Star Congress Supak Top Decision Dallas Testington Dallas Testington
Exposure	Not barmful.		7.2	7. CHEMICAL REACTIVITY Reactivity with Water: No reaction Reactivity with Common Materials: No reaction Submitty During Transport: Occur, only above metring point of 12.5 or yielding aumonia and other products. The decomposition is not explosive. Nourtedizing Agents for Anida and	4 Frad Chemical Co. Yazoo Ciri, Miss. 9(1)4
Water Pollution	Effect of low concentrations on a May be dangerous if it enters wat Nuitify local health and widthe Notify operators of nearby water	er intakes. Afficials.	7.5	Caustics: Not pertunent Polymerization: Not pertunent Inhibitor of Polymerization: Not pertunent	10. SHIPPING INFORMATION 10.1 Grades or Purity: Various grades and parties, which depend on manufactor or process and intended use. All have essentially the same hazardous properties. 10.2 Storage Temperature: Ambient. 10.3 Inert Atmosphere: No requirement. 10.4 Venting: Open.
	NSE TO DISCHARGE tethods Handbook, CG 446-4) (lush	2. LABELS  No hazard label required by Code of Federal Regulations		11. HAZARD ASSESSMENT CODE (See Hazard Assessment Handbook CG 446-3) SS	13. PHYSICAL AND CHEMICAL PROPERTIES 13.1 Physical State at 15°C and 1 atm: Noted 13.2 Molecular Weight: 40106 13.3 Boiling Point at 1 atm: Decomposes 13.4 Freezing Point: 271.1 = 133.C = 406.K
3 1 Synonyme: ( , ( , )	arbons Idiamide Compatibility Classification: of applicable mula: NH; CONH; Nations Numerical	4. OBSERVABLE CHARACTERISTICS 4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: Odorless, or slight ammonia odor	12.	12. HAZARD CLASSIFICATIONS Code of Federal Regulations: Not listed NAS Hazard Rating for Bulk Water Transportation: Not Insted NEPA Hazard Classifications: Not listed	13.5 Critical Temperature: Not pertonent 13.6 Critical Pressure: Not pertonent 13.7 Specific Gravity: 1.94 at 20.1 C (solid) 13.8 Liquid Surface Tension: Not pertonent 13.9 Liquid-Water Interfecial Tension: Not pertonent 13.10 Vapor (Gas) Specific Gravity: Not pertonent 13.11 Ratio of Specific Heels of Vapor (Gas): Not pertonent 13.12 Latent Heat of Vaporization: Not pertonent 13.13 Latent Heat of Vaporization: Not pertonent 13.13 Latent Heat of Vapor (Fig. 1) 13.14 Latent Heat of Vapor (Fig. 1) 13.15 Latent Heat of Vapor (Fig. 1) 13.16 Latent Heat of Combustion: — 991.8 Htm 1)
5 2 Symptoms Fol 5 3 Treatment for 5 4 Toxicity by Inh 5 5 Short-Term In 5 6 Toxicity by Ing 5 7 Late Toxicity: 5 8 Vaper (Gae) In	ritant Characteristics: Non-yo d Irritant Characteristics: Non-	ace sheld, dust mask eves  (): Not pertinent			= -2174.cd g = -91.02 × for 1 kg 13.14 Heat of Decomposition: Not pertinent 13.15 Heat of Solution: -108 Hu in -101 Lul g = -2.52 × 1013 kg 13.16 Heat of Polymerization: Not pertinent  Continued in page 5 and 6
	on primon			N	OTES

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OSAF/PA	ĩ	HQ SAC/SGPB	ī
HQ USAF/LEEV	1	HQ AFESC/DEV	ī
HQ USAF/SGPA	ī	HQ AFESC/TST	ī
HQ USAF/LEEEV	ī	HQ AFESC/RDVA	10
HQ AFSC/DEV	ī	NEPSS	1
HQ AFSC/SGB	i		1
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SD/YVAS	1	USAF Clinic Lowry/SGPM	1
SD/SGX	1	USAF Hospital McConnell/SGPB	1
SD/DEV	2	Mr Bill Wood, TS-792	1
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OL-AD; USAF OEHL	1	SOUTHNAVFACENGCOM	1
HQ USAFE/SGP	1	All Base Environmental	_
USAF Hospital Weisbaden/SGP	2	Coordinators	1
HQ AUL/LSE 71-249	1	All Base Bioenvironmental	•
1 STARD/SEM	1		1
USAF Hospital Vandenberg/SGP	ī	Engineers	1
6585 Test Group (TKS)	ī		
SAALC/SFQT	ī		
Ch, Pollution Abatement Br	1		
NAVFAC. Code 111	1		
NAVIAG, Code III	1		
NESO	1		
NCEL, Code 15111	1		
Commandant/GDD	1		
HQ NASA, Code MAS-7	ī		
NASA/DL-DED-32	ī		
NASA/ME-E	ī		
EPA/ESRL	ī		
Library Chemical Abstracts Svc	1		
Toxic Matls Information Ctr	1		
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Ch, Environmental Chem Div USAEHA	1		
	1		
Commander, USA Med Bioengrg	1		
R&D Lab, ATTN: SGRD/UBG	•		
Ch, Industrial Hyg Div/USAEHA	1		
USA Chief, R&D/EQ	1		
USN, Chief, R&D/EQ	1		
SAMTEC/SEM	2		
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